



The University of New South Wales

Applied Science

1982
Faculty Handbook

How to use this Handbook

The information in this book has been divided into **seven parts**.

General Information (the lilac coloured pages) lists what you need to know about the University as a whole, introduces some of the services available and notes the most important rules and procedures. You should read this part in its entirety.

For further information about the University and its activities, see the University Calendar.

Faculty Information.

Undergraduate Study outlines the courses available in each school in the faculty.

Graduate Study is about higher degrees.

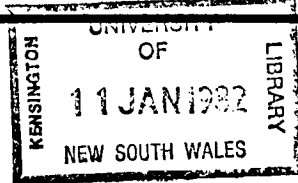
Subject Descriptions lists each subject offered by the schools in the faculty. The schools are listed numerically.

Information includes:

- Subject number, title and description
- Prerequisite, co-requisite and excluded subjects, where applicable
- Additional information about the subject such as unit values, credit hours, teaching hours per week, sessions when taught

Financial Assistance to Students is a list of scholarships and prizes, available at undergraduate and graduate level in the faculty.

Staff list.



The University of New South Wales

Applied Science

1982
Faculty Handbook

The address of the University of
New South Wales is:

PO Box 1, Kensington,
New South Wales, Australia 2033

Telephone: (02) 663 0351

Telegraph: UNITECH, SYDNEY

Telex AA26054

The University of New South Wales Library has catalogued this work as follows:

UNIVERSITY OF NEW SOUTH WALES —

Faculty of Applied Science

Handbook.

Annual. Kensington.

1968 +

University of New South Wales — *Faculty of Applied Science* — Periodicals.

Subjects, courses and any arrangements for courses including staff allocated, as stated in the Calendar or any Handbook or any other publication, announcement or advice of the University, are an expression of intent only and are not to be taken as a firm offer or undertaking. The University reserves the right to discontinue or vary such subjects, courses, arrangements or staff allocations at any time without notice.

Information in this Handbook has been brought up to date as at 14 September 1981, but may be amended without notice by the University Council.

Contents

General Information	1
Some People Who Can Help You	1
Calendar of Dates	
The Academic Year	2
1982	2
1983	4
Organization of the University	5
Arms of the University/Council/Professional Board/Faculties/Boards of Study/Schools/Executive Officers/Administration/Student Representation/Award of the University Medal/Subject Numbers/Textbook Lists/Co-operative Bookshop/General Studies	
Student Services and Activities	
Accommodation	7
<i>Residential Colleges</i>	7
<i>Other Accommodation</i>	7
Associations, Clubs and Societies	7
<i>The Sports Association</i>	7
<i>School and Faculty Associations</i>	8
Australian Armed Services	8
Chaplaincy Centre	8
Deputy Registrar (Student Services)	8
Sport and Recreation Section	8
<i>Physical Education and Recreation Centre</i>	8
Student Counselling and Research Unit	9
Careers and Employment Section	9
Student Health Unit	9
The Students' Union	9
The University Library	10
The University Union	10
Financial Assistance to Students	11
Tertiary Education Assistance Scheme/Other Financial Assistance/Financial Assistance to Aboriginal Students/Fund for Physically Handicapped and Disabled Students	

Rules and Procedures	11
General Conduct	12
Appeals 12	
Admission and Enrolment	12
First Year Entry/Deferral of First Year Enrolment	
Enrolment Procedures and Fees Schedules 1982	
1. Introduction 2. New Undergraduate Enrolments 13. 3. Re-enrolment 13. 4. Restrictions Upon Re-enrolling 13. 5. New Research Students 13. 6. Re-enrolling Research Students 13. 7. Submission of Graduate Thesis or Project Report 13. 8. Enrolments by Miscellaneous Students 13. 9. Final Dates for Completion of Enrolment 13. 10. University and University Union Membership Card 14. 11. Payment of Fees 14. 12. Assisted Students 14. 13. Extension of Time 14. 14. Failure to Pay Fees and Other Debts 14. 15. Student Fees 14. 16. Penalties 15. 17. Exemptions — Fees 15. 18. Variations in Enrolment (including Withdrawal) 16. 19. Exemption — Membership 17	
Private Overseas Students	17
Leave of Absence	17
Course Transfers	17
Admission with Advanced Standing	17
Resumption of Courses	18
Examinations	18
Restrictions upon Students Re-enrolling	20
Schedule A	22
Admission to Degree or Diploma	22
Attendance at Classes	23
Student Records	23
Release of Information to Third Parties	23
Change of Address	23
Ownership of Students' Work	24
Notices	24
Parking within the University Grounds	24
Academic Dress	24
Further Information	24
 Vice-Chancellor's Official Welcome to New Students	 24

Foreword	25
-----------------	----

Faculty Information	26
Who to Contact	26
Enrolment Procedures	26
Student Clubs and Societies	26
Library Facilities	27
Bachelor of Social Science Degree Course (3420)	27
Conditions for the Award of the Degree of Bachelor of Science or Bachelor of Engineering	27
Conditions for the Award of the Degrees of Bachelor of Science (Technology) and Bachelor of Science (Engineering)	28
General Studies Program	28

Undergraduate Study: Course Outlines	29
School of Applied Geology	30
300 Applied Geology (BSc) Full-time (New Course)	30
School of Chemical Engineering and Industrial Chemistry	31
3040 Chemical Engineering (BE) Full-time	31
3040 Chemical Engineering (BE) Full-time/Part-time	34
3100 Industrial Chemistry (BSc) Full-time	35
3110 Industrial Chemistry (BSc(Tech)) Part-time	36
Options in Course 3040 Chemical Engineering	37
Chemical Engineering	37
Fuel Engineering	37
Biological Process Engineering	37
Options in Course 3100 Industrial Chemistry	37
Polymer Science	37

School of Food Technology	38
3060 Food Technology (BSc) Full-time	38
3070 Food Technology (BscTech) Part-time	39
School of Geography	40
3010 Applied Geography (BSc) Full-time	40
School of Metallurgy	42
3120 Metallurgy (BSc) Full-time	43
3180 Metallurgical Process Engineering (BE) Full-time	44
3130 Metallurgy (BScTech) Part-time	44
3020 Ceramic Engineering (BSc) Full-time	45
3030 Ceramics (BscTech) Part-time	46
School of Mining Engineering	47
3140 Mining Engineering (BE) Full-time	47
4200 Mining Engineering (BE) 6 Stage Part-time (W S & L B. Robinson University College, Broken Hill)	48
4210 Mining Engineering (BSc(Eng)) 6 Stage Part-time (W S & L B Robinson University College, Broken Hill)	49
4190 Mining Engineering (BE) Full-time (W S & L B. Robinson University College, Broken Hill)	50
4220 Mineral Processing (BScTech) Part-time (W S & L B Robinson University College, Broken Hill)	50
School of Textile Technology	51
3170 Textile Technology (BSc) Full-time	51
School of Wool and Pastoral Sciences	53
3220 Wool and Pastoral Sciences (BSc) Full-time	53

Graduate Study	55
Graduate Enrolment Procedures	55
Graduate Study	55
Faculty of Applied Science	56
8025 Arid Lands Management (MAppSc)	56
5025 Arid Lands Management (GradDip)	58
8026 Remote Sensing (MAppSc)	59
8045 Environmental Studies (MEnvStudies)	60
School of Applied Geology	61
8020 Engineering Geology-Hydrogeology-Environmental Geology Course (MAppSc)	61
8091 Mineral Exploration Graduate Course (MAppSc)	61
8092 Exploration Geophysics Graduate Course (MAppSc)	61
8093 Exploration Geochemistry Graduate Course (MAppSc)	62
School of Chemical Engineering and Industrial Chemistry	63
8000 Bioprocess Engineering (MAppSc)	63
8005 Chemical Technology Graduate Course (MAppSc)	64
8010 Chemical Engineering (MAppSc)	65
8040 Environmental Pollution Control (MAppSc)	65
8060 Fuel Technology (MAppSc)	65
8080 Industrial Pollution Control (MAppSc)	66
5010 Corrosion Technology (GradDip)	66
School of Food Technology	67
8030 Food Technology Graduate Course (MAppSc)	67
5020 Food Technology (GradDip)	67
School of Metallurgy	68
8050 Metallurgy Graduate Course (MAppSc)	68
School of Mining Engineering	69
8055 Minerals Engineering (MAppSc)	69
5040 Mining and Mineral Engineering (GradDip)	69
School of Wool and Pastoral Sciences	70
5080 Wool Technology (GradDip)	70

Graduate Study: Conditions for the Award of Higher Degrees	71
Doctor of Philosophy	73
Master of Applied Science	75
Master of Engineering	77
Master of Environmental Studies	78
Master of Science	78
Master of Science and Master of Engineering <i>without supervision</i>	80
Graduate Diploma	81

Subject Descriptions	82
Identification of Subjects by Number	82
School of Physics	
Undergraduate Study	84

School of Chemistry		
Undergraduate Study	.....	85
Graduate Study	.....	87
School of Metallurgy		
Undergraduate Study	.....	87
Graduate Study	.....	91
School of Mechanical and Industrial Engineering		
Undergraduate Study	.....	92
(See also Department of Industrial Engineering below)		
School of Electrical Engineering and Computer Science		
Undergraduate Study	.....	94
Graduate Study	.....	94
School of Mining Engineering		
Undergraduate Study	.....	95
Graduate Study	.....	98
School of Civil Engineering		
Undergraduate Study	.....	100
Graduate Study	.....	101
School of Wool and Pastoral Sciences		
Undergraduate Study	.....	102
Graduate Study	.....	104
School of Mathematics		
Undergraduate Study	.....	105
School of Psychology		
Undergraduate Study	.....	107
School of Textile Technology		
Undergraduate Study	.....	107
School of Accountancy		
Undergraduate Study	.....	108
School of Economics		
Undergraduate Study	.....	109
Biological Sciences		
Undergraduate Study	.....	111
Department of Industrial Engineering		
Undergraduate Study	.....	111
School of Nuclear Engineering		
Undergraduate Study	.....	111
School of Applied Geology		
Undergraduate Study	.....	112
Graduate Study	.....	116
School of Geography		
Undergraduate Study	.....	118
Graduate Study	.....	122
School of Marketing		
Undergraduate Study	.....	124
School of Surveying		
Undergraduate Study	.....	124
Graduate Study	.....	124
Department of Organizational Behaviour		
Graduate Study	.....	125
School of Town Planning		
Undergraduate Study	.....	125
Graduate Study	.....	125
School of Landscape Architecture		
Undergraduate Study	.....	125
School of Food Technology		
Undergraduate Study	.....	126
Graduate Study	.....	129

Graduate School of the Built Environment	
<i>Graduate Study</i>	130
School of Biochemistry	
<i>Undergraduate Study</i>	131
School of Biotechnology	
<i>Undergraduate Study</i>	131
<i>Graduate Study</i>	132
School of Botany	
<i>Undergraduate Study</i>	132
School of Microbiology	
<i>Undergraduate Study</i>	133
School of Zoology	
<i>Undergraduate Study</i>	133
<i>Graduate Study</i>	134
Faculty of Applied Science	
<i>Graduate Study</i>	134
<i>Environmental Studies</i>	134
School of Chemical Engineering and Industrial Chemistry	
<i>Undergraduate Study</i>	135
<i>General</i>	135
<i>Department of Biological Process Engineering</i>	141
<i>Department of Fuel Technology</i>	141
<i>Department of Polymer Science</i>	142
<i>Graduate Study</i>	142
<i>General</i>	142
<i>Department of Biological Process Engineering</i>	145
<i>Department of Fuel Technology</i>	146
<i>Department of Polymer Science</i>	147
School of Sociology	
<i>Undergraduate Study</i>	147
School of Political Science	
<i>Undergraduate Study</i>	148
Australian Graduate School of Management	
<i>Graduate Study</i>	148

Financial Assistance to Students

Scholarships	149
<i>Undergraduate</i>	149
<i>Graduate</i>	153
Prizes	156
<i>Undergraduate</i>	156
<i>Graduate</i>	160

Staff

Faculty of Applied Science	161
Broken Hill Division	166

Tuition Fees

When the following coloured pages were printed the University did not have complete information about the introduction of tuition fees for some students in 1982.

These coloured pages should not be taken as a definitive statement about fees, except for section 15. Fees, pages 14, 15.

The University's *Enrolment Procedures and Fees Schedule 1982*, as printed in the 1982 Calendar and available as a separate booklet in November 1981, contains more detailed information.

General Information

To obtain the maximum benefit from your studies you should make an effort to learn what facilities the University offers, to investigate the best methods of study and to discover as much as possible about the course for which you are enrolled.

This Handbook has been specially designed as a detailed source of reference for you in all matters related to your Faculty. This General Information Section is intended to help you put the Faculty into perspective with the University as a whole, to introduce you to some of the services available to students and to note some of the most important rules and procedures.

For fuller details about some aspects of the University and its activities you might need to consult the University Calendar.

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 663 0351 and ask for the extension or dial 662 – and then the extension number. This prefix should only be used when you are certain of the extension that you require. Callers using 662 cannot be transferred to any other number.

Some people who can help you

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

The Deputy Registrar (Student Services), Mr Peter O'Brien, and his Administrative Assistant, Mrs Anne Beaumont, are located on the first floor of the Chancellery. They will help those students who need advice and who have problems but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with general enquiries they are especially concerned with the problems of physically handicapped and disabled students. Enquire at room 148E, phone 2482.

The Assistant Registrar (Admissions and Examinations), Mr Jack Hill, is located on the ground floor of the Chancellery. General enquiries should be directed to 3715. For information regarding examinations, including examination timetables and clash of examinations, contact the Senior Administrative Officer, Mr John Grigg, phone 2143.

The Assistant Registrar (Student Records and Scholarships – Undergraduate and Postgraduate), Mr Graham Mayne is located on the ground floor of the Chancellery. For particular enquiries regarding illness and other matters affecting performance in examinations and assessment, academic statements, graduation ceremonies, prizes, release of examination results and variations to enrolment programs, phone 3711.

The Adviser for Prospective Students, Mrs Fay Lindsay, is located in the Chancellery and is available for personal interview. For an appointment phone 3453.

The Assistant Registrar (Careers and Employment), Mr Jack Foley, is located in the Chancellery. Enquiries should be directed to 3259.

The Off-campus Housing Officer, Mrs Judy Hay, is located in Room 148E in the Chancellery. For assistance in obtaining suitable lodgings phone 3260.

Student Loans enquiries should be directed to Mrs Judy Hay, Room 148E in the Chancellery, phone 3164.

The Student Health Unit is located in Hut E15b at the foot of Basser Steps. The Director is Dr Geoffrey Hansen. For medical aid phone 2679, 2678 or 2677.

The Student Counselling and Research Unit is located at the foot of Basser Steps. For assistance with educational or vocational problems ring 3681 or 3685 for an appointment.

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

The Chaplaincy Centre is located in Hut E15a at the foot of Basser Steps. For spiritual counselling phone Anglican – 2684; Catholic – 2379; Greek Orthodox – 2683; Lutheran – 2683; Uniting Church – 2685.

The Students' Union is located on the second floor of Stage III of the University Union, where the SU President, Secretary-Treasurer, Education Vice-President, Welfare-Research Officer, and Director of Overseas Students are available to discuss any problems you might have.

Cashier's Hours The University Cashier's office is open from 9.30 am to 1.00 pm and from 2.00 pm to 4.30 pm, Monday to Friday. It is open for additional periods at the beginning of Session 1. Consult noticeboards for details.

Calendar of Dates

The Academic Year

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

Session 1 commences on the first Monday of March.

1982

Faculties other than Medicine

Session 1	1 March to 9 May
(14 weeks)	<i>May Recess:</i> 10 May to 16 May
	17 May to 13 June
	<i>Midyear Recess:</i> 14 June to 18 July
Examinations	15 June to 30 June
Session 2	19 July to 22 August
(14 weeks)	<i>August Recess:</i> 23 August to 29 August
	30 August to 31 October
	<i>Study Recess:</i> 1 November to 7 November
Examinations	8 November to 26 November

Faculty of Medicine

First and Second Years	As for other faculties	
Third and Fourth Years	Term 1 (10 weeks)	26 January to 4 April
	Term 2 (9 weeks)	13 April to 9 May
	<i>May Recess:</i> 10 May to 16 May	17 May to 20 June
	Term 3 (8 weeks)	28 June to 22 August
	Term 4 (11 weeks)	30 August to 14 November
Fifth Year	Term 1 (8 weeks)	26 January to 21 March
	Term 2 (8 weeks)	29 March to 23 May
	Term 3 (8 weeks)	31 May to 25 July
	Term 4 (8 weeks)	2 August to 26 September
	Term 5 (8 weeks)	5 October to 28 November

January

Friday 1	New Year's Day – Public Holiday
Monday 4	Last day for applications for review of results of <i>annual</i> examinations
Friday 8	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University

February		June	
Monday 1	Australia Day – Public Holiday	Tuesday 1	Publication of timetable for June/July examinations
Thursday 4	Enrolment period begins for new undergraduate students and undergraduate students repeating first year	Sunday 13	Session 1 ends
		Monday 14	Queen's Birthday – Public Holiday
Monday 15	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses	Tuesday 15	Midyear Recess begins
		Wednesday 30	Examinations begin
			Examinations end
March		July	
Monday 1	Session 1 commences Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out their degree for any other reason	Monday 12	Examination results mailed to students
		Tuesday 13	Examination results displayed on University noticeboards
		Tuesday 13 to Friday 16	Students to amend enrolment programs following receipt of June examination results
Wednesday 10	List of graduands for April/May ceremonies and of 1981 prize-winners published in <i>The Sydney Morning Herald</i>	Sunday 18	Midyear Recess ends
		Monday 19	Session 2 begins
Friday 12	Last day for acceptance of enrolment by new undergraduate students (late fee payable thereafter)		Last day for application for review of June examination results
Monday 15	Last day for notification of correction of details published in the press on 10 March concerning April/May graduation ceremonies	Thursday 29	Foundation Day (no classes held)
		Friday 30	Last day for students to discontinue without failure subjects which extend over the whole of academic year
Friday 26	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable thereafter)	August	
		Monday 23	August Recess begins
		Sunday 29	August Recess ends
		Tuesday 31	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out their degree for any other reason
April		September	
Friday 9 to Monday 12	Easter	Friday 3	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Friday 16	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only	Wednesday 8	List of graduands for October graduation ceremonies published in <i>The Sydney Morning Herald</i>
Sunday 25	Anzac Day		Confirmation of Enrolment form forwarded to all students
Monday 26	Public Holiday	Monday 13	Last day for notification of correction of details published in the press on 9 September concerning October graduation ceremonies
Tuesday 27	Confirmation of Enrolment forms despatched to all students		Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit <i>Application for Admission to Degree</i> form
May		Wednesday 22	Last day for acceptance of corrected <i>Confirmation of Enrolment</i> forms
Wednesday 5	Last day for undergraduate students completing requirements for degrees or diplomas at the end of Session 1 to submit <i>Application for Admission to Degree</i> form		Last day to apply to UCAC for transfer to another tertiary institution in New South Wales
	Last day for acceptance of corrected <i>Confirmation of Enrolment</i> forms		Publication of provisional examination timetable
Monday 10	May Recess begins	Thursday 30	
Thursday 13	Publication of provisional timetable for June/July examinations		
Sunday 16	May Recess ends		
Friday 21	Last day for students to advise of examination timetable clashes		

October	
Monday 4	Eight Hour Day – Public Holiday
Friday 8	Last day for students to advise of examination timetable clashes
Thursday 21	Publication of timetable for examinations
Sunday 31	Session 2 ends
November	
Monday 1	Study Recess begins
Sunday 7	Study Recess ends
Monday 8	Examinations begin
Friday 26	Examinations end
December	
Monday 13	Examination results mailed to students
Tuesday 14	Examination results displayed on University noticeboards
Monday 20	List of graduands in Medicine for February graduation ceremony published in <i>The Sydney Morning Herald</i>
Saturday 25	Christmas Day – Public Holiday
Sunday 26	Boxing Day – Public Holiday

1983

Faculties other than Medicine

Session 1 (14 weeks)	7 March to 15 May <i>May Recess:</i> 16 May to 22 May 23 May to 19 June <i>Midyear Recess:</i> 20 June to 24 July 21 June to 6 July
Examinations	
Session 2 (14 weeks)	25 July to 28 August <i>August Recess:</i> 29 August to 4 September 5 September to 6 November <i>Study Recess:</i> 7 November to 13 November
Examinations	14 November to 2 December

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 24 January to 3 April Term 2 (9 weeks) 11 April to 15 May <i>May Recess:</i> 16 May to 22 May 23 May to 19 June Term 3 (9 weeks) 27 June to 28 August Term 4 (10 weeks) 5 September to 13 November
Fifth Year	Term 1 (8 weeks) 24 January to 20 March Term 2 (8 weeks) 28 March to 22 May Term 3 (8 weeks) 30 May to 24 July Term 4 (8 weeks) 1 August to 25 September Term 5 (8 weeks) 4 October to 27 November

January

Monday 3	Public Holiday
Tuesday 4	Last day for applications for review of results of <i>annual</i> examinations
Friday 7	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University
Monday 31	Australia Day – Public Holiday

February

Tuesday 8	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 21	Enrolment period begins for second and later year undergraduate students and students enrolled in formal graduate courses

March

Monday 7	Session 1 begins – all courses except Medicine III, IV and V
----------	--

April

Friday 1 to Monday 4	Easter – Public Holiday
Monday 25	Anzac Day – Public Holiday

Organization of the University

Rapid development has been characteristic of the University of New South Wales since it was first incorporated by an Act of Parliament in 1949, under the name of the New South Wales University of Technology.

In 1981 the University had 18,844 students and over 3,700 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W.S. and L.B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

Arms of the University of New South Wales

The arms of the University are reproduced on the front cover of this handbook. The arms were granted by the College of Heralds in London, on 3 March 1952, and the heraldic description is as follows:

'Argent on a Cross Gules a Lion passant guardant between four Mullets of eight points Or a Chief Sable charged with an open Book proper thereon the word SCIENTIA in letters also Sable.

'The lion and the four stars of the Southern Cross on the Cross of St George have reference to the State of New South Wales which brought the University into being; the open book with SCIENTIA across its page reminds us of its original purpose. Beneath the shield is the motto 'Manu et Mente', which is the motto of the Sydney Technical College, from which the University has developed. The motto is not an integral part of the Grant of Arms and could be changed at will; but it was the opinion of the University Council that the relationship with the parent institution should in some way be recorded.'

The Council

The chief governing body of the University is the Council which has the responsibility of making all major decisions regarding its policy, conduct and welfare.

The Council consists of 44 members from the State Parliament, industry and commerce, agriculture, the trade unions, professional bodies, the staff, the students and the graduates of the University.

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

The Chairman of the Council is the Chancellor, the Hon. Mr Justice Samuels.

The Professorial Board

The Professorial Board is one of the two chief academic units within the University and includes all the professors from the various faculties. It deliberates on all questions such as matriculation requirements, the content of courses, the arrangement of syllabuses, the appointment of examiners and the conditions for graduate degrees. Its recommendations on these and similar matters are presented to Council for its consideration and adoption.

The Faculties/Boards of Study

The Dean, who is also a professor, is the executive head of the Faculty or Board of Study. Members of each Faculty or Board meet regularly to consider matters pertaining to their own areas of study and research, the result of their deliberations being then submitted to the Professorial Board.

The term 'faculty' is used in two distinct senses in the University. Sometimes it is used to refer to the group of schools comprising the faculty, and at others to the deliberative body of academic members of the Schools within the Faculty.

The eleven faculties are Applied Science, Architecture, Arts, Biological Sciences, Commerce, Engineering, Law, Medicine, Military Studies, Professional Studies and Science. In addition, the Board of Studies of the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education fulfil a function similar to that of the faculties. The Board of Studies in Science and Mathematics, which was established to facilitate the joint academic administration of the Science and Mathematics degree course by the Faculties of Biological Sciences and Science, considers and reports to the Professorial Board on all matters relating to studies, lectures and examinations in the science and mathematics degree course.

The Schools

Once courses of study have been approved they come under the control of the individual schools (eg the School of Chemistry, the School of Mathematics). The head of the school in which you are studying is the person in this academic structure with whom you will be most directly concerned.

Executive Officers

As chief executive officer of the University, the Vice-Chancellor and Principal, Professor Rupert Myers, is charged with managing and supervising the administrative, financial and other activities of the University.

He is assisted in this task by two Pro-Vice-Chancellors, Professor Ray Golding and Professor Rupert Vallentine, together with the Deans and the three heads of the administrative divisions.

General Administration

The administration of general matters within the University comes mainly within the province of the Registrar, Mr Ian Way, the Bursar, Mr Tom Daly, and the Property Manager Mr Peter Koller.

The Registrar's Division is concerned chiefly with academic matters such as the admission of students, and the administration of examinations as well as the various student services (health, employment, amenities, and counselling).

The Bursar's Division is concerned with the financial details of the day-to-day administration and matters to do with staff appointments, promotions, etc.

The Property Division is responsible for the building program and the 'household' services of the University (including electricity, telephones, cleaning, traffic and parking control and maintenance of buildings and grounds).

Student Representation on Council and Faculties/Boards

Three members of the University Council may be students elected by students. All students who are not full-time members of staff are eligible to stand for a two-year term of office. The students who are elected to the Council are eligible for election to the Committees of Council.

Students proceeding to a degree or a graduate diploma may elect members for appointment by the Council to their Faculty/Board. Elections are for a one-year term of office.

Open Faculty/Board Meetings

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

Award of the University Medal

The University may award a bronze medal to undergraduate students who have achieved highly distinguished merit on completion of their final year.

Identification of Subjects by Numbers

For information concerning the identifying number of each subject taught in each Faculty as well as the full list of identifying numbers and subjects taught in the University, turn to the first page of the section Subject Descriptions. This list is also published in the Calendar.

Textbook Lists

Textbook lists are no longer published in the Faculty handbooks. Separate lists are issued early in the year and are available at key points on the campus.

Students should allow quite a substantial sum for textbooks. This can vary from \$250 to \$600 per year depending on the course taken. These figures are based on the cost of new books. The Students' Union operates a secondhand bookshop. Information about special equipment costs, accommodation charges and cost of subsistence on excursions, field work, etc, and for hospital residence (medical students) are available from individual schools.

Co-operative Bookshop

Membership is open to all students, on initial payment of a fee of \$10, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

General Studies Program

Almost all undergraduates in faculties other than Arts and Law are required to complete a General Studies program. The Department of General Studies within the Board of Studies in General Education publishes its own Handbook which is available free of charge. All enquiries about General Studies should be made to the General Studies Office, Room G56, Morven Brown Building, phone 3476.

Student Services and Activities

Accommodation

Residential Colleges

There are seven residential colleges on campus. Each college offers accommodation in a distinctive environment which varies from college to college, as do facilities and fees. A brief description of each college is given below, and further information may be obtained directly from the individual colleges. In addition to basic residence fees, most colleges make minor additional charges for such items as registration fees, caution money or power charges. Intending students should lodge applications before the end of October in the year prior to the one in which they seek admission. Most colleges require a personal interview as part of the application procedure.

The Kensington Colleges

The Kensington Colleges comprise Basser College, Goldstein College and Philip Baxter College. They house 450 men and women students, as well as tutorial and administrative staff members. Fees are payable on a session basis. Apply in writing to the Master, Mr K. W. Bromham, PO Box 24, Kensington, NSW 2033.

International House

International House accommodates 154 students from Australia and up to thirty other countries. Preference is given to more senior undergraduates and graduate students. Apply in writing to the Warden, Emeritus Professor J. S. Ratcliffe, International House, PO Box 1, Kensington, NSW 2033.

New College

New College is an Anglican college and it provides accommodation (with all meals) for 220 graduates and undergraduates, without regard to race, religion, or sex. The College has its own resident tutors, and sponsors a wide range of sporting and social activities. Apply to Dr Stuart Barton Babbage, Master, New College, Anzac Parade, Kensington 2033 (telephone 662 6066).

Shalom College

Shalom College is a Jewish residential college. It provides accommodation for 86 men and women students. Non-resident membership is available to students who wish to avail themselves of the Kosher dining room and tutorial facilities. Fees are payable on a session basis. Conferences are catered for, particularly with Kosher requirements. Rates are available on application. Apply in writing to the Master, Dr S. Engelberg, Shalom College, the University of New South Wales, PO Box 1, Kensington, NSW 2033.

Warrane College

Warrane is a men's college catering for 200 students of all ages, backgrounds and beliefs. A comprehensive tutorial program is offered along with a wide range of activities, professional orientation, and opportunities to meet members of the University staff informally. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. The activities of a spiritual nature conducted at Warrane have been entrusted to the Catholic association Opus Dei. Apply in writing to the Master, Dr J. F. Martins, Warrane College, PO Box 123, Kensington, NSW 2033.

Creston Residence

Creston Residence offers accommodation to 25 undergraduate and graduate women students. Activities and tutorials are open to non-resident students. The spiritual activities offered at Creston are entrusted to the Women's Section of Opus Dei. Enquiries: 36 High Street, Randwick 2031. Telephone (02) 398 5693.

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may contact the Housing Officer in the Chancellery, Room 148E for assistance in obtaining suitable accommodation in the way of rooms with cooking facilities, flats, houses, share flats etc. Extensive listings of all varieties of housing are kept up-to-date throughout the year and during vacations. Accommodation in the immediate vicinity of the University is not usually easy to find at short notice, and is expensive.

No appointment is necessary but there may be some delay in February and March. The Housing staff are always happy to discuss any aspect of accommodation.

Special pamphlets on accommodation, lists of estate agents and hints on house-hunting are available on request.

Associations, Clubs and Societies

The Sports Association

The Sports Association is a student organization within the University which caters for a variety of sports for both men and women. In December 1952 the University Council approved the establishment of the Sports Association, which then consisted of five clubs. As the University has grown the Association has expanded, and it now includes thirty-eight clubs.

The Association office is situated in Hut E15C near the foot of Basser Steps, and can be contacted on extension

2673. The control of the Association is vested in the General Committee which includes delegates from all the clubs.

Membership is compulsory for all registered students, and the annual fee is \$17. Membership is also open to all members of staff and graduates of the University on payment of an annual fee as prescribed in the By-Laws of the Association. All members are invited to take part in any of the activities arranged by the Association, and to make use of the University's sporting and recreational facilities.

The Association is affiliated with the Australian Universities Sports Association (AUSA) which is the controlling body for sport in all Australian universities.

School and Faculty Associations

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

Australian Armed Services

The University maintains links with the Royal Australian Navy, the Australian Army Reserve and the Royal Australian Air Force, and opportunities exist for student participation in their activities. See the General Information section of the Faculty Handbooks for details.

Chaplaincy Centre

The University Chapel

The University provides a small chapel for the use of all faiths. In its temporary housing it is located in Hut E15a near the Chemistry Building. The chapel is available for services of worship by arrangement with the full-time chaplains. At other times it is available for private meditation to all members of the University.

Chaplaincy Service

A Chaplaincy Service is available within the University of New South Wales for the benefit of students and staff.

The Service offers fellowship, personal counselling and guidance, together with leadership in biblical and doctrinal studies and in worship. The Chaplains maintain close liaison with student religious societies.

The chaplains are located in Hut E15a at the foot of Basser steps, which also contains the temporary chapel.

Deputy Registrar (Student Services)

The Deputy Registrar (Student Services), Mr Peter O'Brien, and his Administrative Assistant, Mrs Anne Beaumont, are located on the first floor of the Chancellery.

They will help those students who have problems and need advice but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with general enquiries they are especially concerned with the problems of physically handicapped and disabled students.

All enquiries should be made either at room 148E or by telephoning extension 2482 (general enquiries).

Sport and Recreation Section

The Sport and Recreation Section seeks ways to encourage students and staff to include exercise as an essential part of their daily lives. It does this through Sports Clubs on a competitive basis and by offering physical recreation on a more casual basis to the University community.

The Section serves the Sports Association and its 38 constituent clubs and is responsible for the continuing management of the Physical Education and Recreation Centre at which recreational programs are available for both students and staff.

It makes bookings for use of sporting facilities including tennis courts and playing fields. The section is located in Hut E15c at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Recreation Program 3271; Grounds Bookings 2235; Sports Association 2673.

Physical Education and Recreation Centre

The Sport and Recreation Section provides a recreational program for students and staff at the Physical Education and Recreation Centre. The Centre consists of eight squash courts, a main building, and a 50-metre indoor heated swimming pool. The main building has a large gymnasium and practice rooms for fencing, table tennis, judo, weight-lifting, karate and jazz ballet, also a physical fitness testing room. The recreational program includes intramurals, teaching/coaching, camping. The Centre is located on the lower campus adjacent to High Street. The Supervisor at PERC may be contacted on extension 3271.

Student Counselling and Research Unit

The Student Counselling and Research Unit provides counselling services to students, prospective students, parents and other concerned persons.

The unit is located in the huts near the foot of Basser Steps (access from College Road or Engineering Road).

Appointments are offered throughout the academic year and during recesses between 8 am to 5 pm on week days (up to 7 pm on some evenings). A 'walk-in' service for short interviews is available between 9 am and 5 pm. Appointments may be made by phoning extension 3685 or 3681 between 8.30 am and 5.30 pm.

Counsellors offer assistance in planning, decision-making, problem solving, social and emotional development, and dealing with grievances. Group programs on such topics as study, tutorial and examination skills, stress management, communicating, and self-confidence are offered each session. Brochures are available from the receptionist.

Careers and Employment Section

The Careers and Employment Section provides careers advice and assistance in finding employment.

Assistance with careers and permanent employment opportunities includes: the regular mailing of a *Job Vacancy Bulletin* to registered students and graduates, a Library, and a Campus Interview Program in which final year students have the opportunity to speak to employers regarding employment prospects.

Assistance is also provided in obtaining course-related employment during long vacations as required by undergraduates in Engineering and Applied Science.

The Section is located in Undercroft Room LG05 in the Chancellery.

For further information, telephone as follows: careers and employment assistance 3259 or 3630; long vacation industrial training 2086.

Student Health Unit

A student health clinic and first aid centre is situated within the University. The medical service although therapeutic is not intended to replace private or community health services. Thus, where chronic or continuing conditions are revealed or suspected the student may be referred to a private practitioner or to an appropriate hospital. The health service is not responsible for fees incurred in these

instances. The service is confidential and students are encouraged to attend for advice on matters pertaining to health.

The service is available to all enrolled students by appointment, free of charge, between 9 am and 5 pm Mondays to Fridays. For staff members, immunizations are available, and first aid service in the case of injury or illness on the campus.

The centre is located in Hut E15b on the northern side of the campus in College Road at the foot of the Basser Steps.

Appointments may be made by calling at the centre or by telephoning extension 2679, 2678 or 2677 during the above hours.

The Family Planning Association of NSW conducts clinics at the Student Health Unit and at the adjacent Prince of Wales Hospital which are available for both staff and students. Appointments may be made for the Student Health Unit clinic by telephoning 588 2833 or for the Prince of Wales Hospital clinics by telephoning 399 0111.

The Students' Union

The Students' Union was formed in 1952 as an organization, duly recognized by the University Council, to represent the student body and to provide a central organization for the administration of student activities. In the words of its constitution 'The Students' Union is formed for the purpose of advancing the interests of University men and women, facilitating their general scientific and technical education, and fostering a University spirit among them'.

The Students' Union affords a recognized means of communication between the student body and the University administration, and represents its members in all matters affecting their interests. It aims to promote the cultural, educational and recreational life of the University and to encourage a permanent interest among graduates in the life and progress of student activities within the University. The Students' Union also makes representations to government and other bodies outside the University on behalf of its members.

Membership of the Students' Union is compulsory for all registered students of the University and the annual subscription is \$17* for full-time students and \$13* for part-time students. All Alumni of the University are eligible for Life Membership.

The Students' Union is governed by a Council consisting in the main of elected student representatives from the various faculties of the University. There are also representatives of the University Council, Life Members, the Staff Association and the Sports Association. The Council is elected annually.

*These fees are at 1981 levels; they are subject to increase in 1982.

A full-time President, elected each year by popular ballot, directs the entire administration of the Students' Union and its activities, assisted by a Secretary-Treasurer.

Other officers are the Education Vice-President who works towards the implementation of Students' Union education policy; the Welfare-Research Officer concerned with helping students with problems they may encounter in the University; the Electronic Media Officer; and the Director of Overseas Students who deals with specific problems these students may encounter while in Australia.

The activities in which the Students' Union is involved include:

1. A casual employment service.
2. Organization of orientation for new students.
3. Organization of Foundation Day.
4. The University's two child care centres.
5. Publication of the student paper *Tharunka*.
6. A free legal service run by a qualified lawyer employed by the Students' Union Council.
7. SU Record Shop which offers discount records and tapes.
8. The Nuthouse which deals in bulk and health foods.
9. Secondhand Bookshop for cheap texts.
10. CASOC (Clubs and Societies on Campus) which provides money from the SU for affiliated clubs and societies on campus.
11. The sale of electronic calculators and accessories at discount rates.
12. Provision of a bail fund.

The SU office is located on the Second Floor, Stage III, the Union.

The University Library

The University libraries are mostly situated on the upper campus. The library buildings house the Undergraduate Library on Level 3, the Social Sciences and Humanities Library on Level 4, the Physical Sciences Library on Level 7 and the Law Library on Level 8. The Biomedical Library is in the western end of the Mathews Building and is closely associated with libraries in the teaching hospitals of the University.

For details consult Faculty Information in the relevant Faculty Handbook.

There are also library services at other centres:

The Water Reference Library situated at Manly Vale (telephone 948 0261) which is closely associated with the Physical Sciences Library.

The library at the Broken Hill Division in the W.S. and L.B. Robinson University College building (telephone 6022/3/4).

The library at the Royal Military College, Duntroon, ACT, serving the Faculty of Military Studies.

Each library provides reference and lending services to staff and students and each of the libraries on the Kensington campus is open throughout the year during day and evening periods. The exact hours of opening vary during the course of the academic year.

Staff and students normally use a machine-readable identification card to borrow from the University libraries.

The University Union

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

The Union is housed in three buildings near the entrance to the Kensington Campus from Anzac Parade. These are the Roundhouse, the Blockhouse and the Squarehouse. Membership of the Union is compulsory at \$65* per year for all registered students and is open to all members of staff and graduates of the University.

The control of the Union is vested in the Board of Management whose Chief Executive Officer is the Warden.

The full range of facilities provided by the Union includes a cafeteria service and other dining facilities, a large shopping centre (including clothing shop and delicatessen); cloak room; travel service; banking, pharmaceutical, optometrical and hairdressing facilities; showers; a graduates' lounge; common, games, reading, meeting, music, practice, craft and dark rooms. The Union also has shops on Campus which cater for student needs, including art materials and calculators. Photocopying, sign printing, and stencil cutting services are also available. The Union also sponsors special concerts (including lunchtime concerts) and conducts courses in many facets of the arts including weaving, photography, creative dance and yoga. Full information concerning courses is contained in a booklet obtainable from the Union's program department.

The University Union should not be confused with the Students' Union or Students' Representative Council as it is known in some other universities. This latter body has a representative function and is the instrument whereby student attitudes and opinions are crystallized and presented to the University and the community.

*This fee is at 1981 level; it is subject to increase in 1982.

Financial Assistance to Students

Tertiary Education Assistance Scheme

Under this scheme, which is financed by the Commonwealth Government, assistance is available for full-time study in approved courses, to students who are not bonded and who are permanent residents of Australia, subject to a means test on a non-competitive basis. The allowances paid are unlikely to be sufficient, even at the maximum rate, for all the living expenses of a student. Family help and/or incomes from vacation or spare-time work would also be needed.

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

- Undergraduate and graduate bachelor degree courses
- Graduate diplomas
- Approved combined bachelor degree courses
- Master's qualifying courses (one year)

The rates of allowance and conditions for eligibility are set out in a booklet obtainable from the Commonwealth Department of Education.

Tertiary students receiving an allowance, and prospective tertiary students, will be sent application forms in January 1982. Forms will also be available from the Admissions Section or the Careers and Employment Section, or from the Director, Department of Education, 59 Goulburn Street, Sydney, NSW 2000 (telephone 218 8800). Continuing students should submit applications as soon as examination results are available. New students should do so as soon as they are enrolled. All students should apply by 31 March 1982, otherwise benefits will not be paid for the earlier months of the year.

It is most important that students advise the TEAS office if at any time they change or discontinue their study programs, as their eligibility for benefits might be affected.

Other Financial Assistance

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

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

2. *Short Term Cash Loans* Donations from various sources have made funds available for urgent cash loans not exceeding \$100. These loans are normally repayable within one month.

3. Early in 1973 the Commonwealth Government made funds available to the University to provide loans to students in financial difficulty. The loans are to provide for

living allowances and other approved expenses associated with attendance at university. Repayment usually commences after graduation or upon withdrawal from the course. Students are required to enter into a formal agreement with the University to repay the loan. The University is unable to provide from the fund amounts large enough for all or even a major part of the living expenses of a student.

From the same source students who are in extremely difficult financial circumstances may apply for assistance by way of a non-repayable grant. In order to qualify for a grant a student must generally show that the financial difficulty has arisen from exceptional misfortune. Grants are rarely made.

The University has also been the recipient of generous donations from the Arthur T. George Foundation, started by Sir Arthur George and his family, for the endowment of a student loan fund.

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

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

Financial Assistance to Aboriginal Students

Financial assistance is available to help Aboriginal students from the Commonwealth Government's Aboriginal Study Grant Scheme. Furthermore, the University may assist Aboriginal students with loans to meet some essential living expenses.

The University has also received a generous bequest from the estate of the late Alice Brooks Gange for the education of Australian aborigines within the University. The University is engaged in consultations with groups and individuals for advice on the most effective ways of using the funds.

All enquiries relating to these matters should be made at the office of the Deputy Registrar (Student Services), Room 148E, in the Chancellery.

Fund for Physically Handicapped and Disabled Students

The University has a small fund (started by a generous gift from a member of staff who wishes to remain anonymous) available for projects of benefit to handicapped and disabled students. Enquiries should be made at the office of the Deputy Registrar (Student Services), Room 148E, in the Chancellery.

Rules and Procedures

The University, in common with other large organizations, has established rules and procedures which are designed for the benefit of all members of the University. In some

cases there are penalties (eg fines or exclusion from examinations) for non-compliance. Any student, who after reading the rules carefully, requires further information on their application should contact the office of the Admissions Section or the Registrar.

General Conduct

The University has not considered it necessary to formulate a detailed code of rules relating to the general conduct of students. Enrolment as a student of the University, however, involves an undertaking to observe the regulations, by-laws and rules of the University, and to pay due regard to any instructions given by any officer of the University.

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'.

Admission and Enrolment

The office of the Admissions Section, located in the Chancellery on the upper campus, provides information for students on admission requirements, undergraduate and graduate courses and enrolment procedures. Faculty handbooks and the Calendar may be purchased here. The office of the Admissions Section is open from 9 am to 5 pm Monday to Friday. During enrolment the office is also open for some part of the evening.

The office provides information about special admission, admission with advanced standing and admission on overseas qualifications. 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 lodgement of applications are adhered to. For further details see the section on Undergraduate and Graduate Enrolment Procedures and Fees.

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on Requirements for Admission) are referred by the Admissions Section to the Admissions Committee of the Professorial Board.

Students seeking to register as higher degree candidates should first consult the Head of the School in which they wish to register. An application is then lodged on a standard form and the Student Records—Postgraduate

Section, after obtaining a recommendation from the Head of 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 undergraduate degree courses at the University may be obtained from the Admissions Office or the Universities and Colleges Admissions Centre.

An Adviser for Prospective Students, Mrs Fay Lindsay, is located in the Chancellery, and is available for personal interview with those who require additional information about the University.

First Year Entry

Those seeking entry to first year courses in one or more of twenty-one tertiary institutions in the state including 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 Universities and Colleges Admissions Centre, Challis House, 10 Martin Place, Sydney 2000 (GPO Box 7049, Sydney 2001). On the application form provision is made for applicants to indicate preferences for courses available in any one of the three universities and eighteen other tertiary institutions. 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. Enrolment is completed at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

Deferment of First Year Enrolment

Students proceeding directly from school to University who have received an offer of a place may request deferment of enrolment for one year and will usually receive permission providing they do not enrol at another tertiary institution in that year.

Enrolment Procedures and Fees Schedules 1982

1. Introduction

All students, except those enrolling in graduate research degree courses (see sections 5. and 6. below), must lodge an authorized enrolment form with the Cashier either on the day the enrolling officer signs the form or on the day any required General Studies electives are approved.

All students, except those enrolling in graduate research degree courses and those exempted as set out in section 17. below, should on that day also either pay the required fees or lodge an enrolment voucher or other appropriate authority.

Such vouchers and authorities are generally issued by the NSW Department of Education and the NSW Public

Service. They are not always issued in time and students who expect to receive an enrolment voucher or other appropriate authority but have not done so must pay the fees and arrange a refund later. Such vouchers and authorities are not the responsibility of the University and their late receipt is not to be assumed as automatically exempting a student from the requirements of enrolling and paying fees.

If a student is unable to pay the fees the enrolment form must still be lodged with the Cashier and the student will be issued with a 'nil' receipt. The student is then indebted to the University and must pay the fees by the end of the second week of the session for which enrolment is being effected. Penalties apply if fees are paid after that time (see section 16. below) unless the student has obtained an extension of time in which to pay fees from the office of the Deputy Registrar (Student Services) (Room 148E, the Chancellery). Such an application must be made before the fee is due. Payment may be made through the mail, in which case it is important that the student registration number be given accurately. Cash should not be sent through the mail.

2. New Undergraduate Enrolments

Persons who are applying for entry in 1982 must lodge an application for selection with the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1981.

Those who are selected will be required to complete enrolment at a specified time before the start of Session 1. Compulsory fees should be paid on the day.

In special circumstances, however, and provided class places are still available, students may be allowed to complete enrolment after the prescribed time.

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

3. Re-enrolment

See also sections 4., 6. and 7. below.

Students who are continuing courses (or returning after approved leave of absence) should enrol through the appropriate school in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Admissions Section and from School offices. Those who have completed part of a course and have been absent without leave need to apply for entry through the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1981.

4. Restrictions Upon Re-enrolling

Students who in 1981 have infringed the rules governing re-enrolment should not attempt to re-enrol in 1982 but should follow the written instructions they will receive from the Registrar.

5. New Research Students

Students enrolling for the first time in graduate research degree courses will receive an enrolment form by post. They have two weeks from the date of offer of registration in which to lodge the enrolment form with the Cashier and pay the appropriate fees. Completion of enrolment after this time will incur a penalty (see section 16. below).

6. Re-enrolling Research Students

Students enrolled in purely research degree programs will be re-enrolled each year and sent an account for any fees due, unless they have lodged a thesis or their registration has been cancelled or suspended.

7. Submission of Graduate Thesis or Project Report

Graduate students who at the commencement of Session 1 have completed all the work for a degree or diploma except for the submission of the relevant thesis or project report are required to re-enrol by the end of the second week of Session 1. Completion of enrolment after then will incur a penalty (see section 16. below) but students enrolled in purely research degree programs will be re-enrolled automatically (see section 6. above).

Information about possible fees exemption is set out in section 17. (10) below.

8. Enrolments by Miscellaneous Students

Enrolments by miscellaneous students are governed by the following rules:

(1) Enrolment in a particular subject or subjects as a miscellaneous student – ie as a student not proceeding to a degree or diploma – may be permitted provided that in every case the Head of School offering the subject considers that the student will benefit from the enrolment and provided also that accommodation is available and that the enrolment does not prevent a place in that subject being available to a student proceeding to a degree or diploma.

(2) A student who is under exclusion from any subject in the University may not be permitted to be enrolled as a miscellaneous student in that subject.

(3) A student who is under exclusion from any course in the University may not be permitted to enrol in any subject which forms a compulsory component of the course from which the student is excluded.

(4) A student who is subsequently admitted to a course of the University for which any subjects completed as a miscellaneous student form a part may receive standing for those subjects.

9. Final Dates for Completion of Enrolment

No enrolments for courses extending over the whole year or for Session 1 only will be accepted from new students after the end of the second week of Session 1 (12 March 1982) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned; no later year enrolments for courses extending over the whole year or for Session 1 only will be accepted after the end of the fourth week of Session 1 (25 March 1982) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned. No enrolments for courses in Session 2 only will be accepted after the end of the second week of Session 2 (30 July 1982) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned.

10. University of New South Wales and University Union Membership Card

All students enrolled in degree or diploma courses or as miscellaneous students, except those exempt from fees under provisions of section 17. below, are issued with a University of New South Wales and University Union Membership Card. This card must be carried during attendance at the University and shown on official request.

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

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

Life members of the University Union and those exempt from payment of University Union fees, if enrolled in degree or diploma courses or miscellaneous students use the University's fees receipt in place of the card when applying for travel concessions and when notifying a change of address. The University Library issues a library borrowing card on production of the fees receipt.

A student who loses a card must notify the University Union as soon as possible.

New students are issued with cards on enrolment if eligible.

11. Payment of Fees

There are no fees for tuition but other fees and charges are payable. These include those charges raised to finance the expenses incurred in operating activities such as the University Union, the Students' Union, the Sports Association, and the Physical Education and Recreation Centre. Penalty payments are also incurred if a student fails to complete procedures as required. Charges may also be

payable, sometimes in the form of a deposit, for the hiring of kits of equipment in certain subjects. Accommodation charges, costs of subsistence on excursions, field work, etc, and for hospital residence (medical students) are payable in appropriate circumstances.

12. Assisted Students

Scholarship holders and 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 by 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.

Those unable to pay their own fees in these circumstances can apply to the office of the Deputy Registrar (Student Services) (Room 148E, the Chancellery) for an extension of time in which to pay. Such an application must be made before the fees are due.

13. Extension of Time

Any student who is unable to pay fees by the due date may apply to the office of the Deputy Registrar (Student Services) (Room 148E, the Chancellery) for an extension of time, which may be granted in extenuating circumstances. Such applications must be made before the due date.

14. Failure to Pay Fees and Other Debts

Any student who fails to pay prescribed fees or charges or is otherwise indebted to the University and who fails either to make a satisfactory settlement of his indebtedness upon receipt of due notice or to receive a special exemption ceases to be entitled to the use of University facilities. Such a student is not permitted to register for a further session, to attend classes or examinations, or to be granted any official credentials. In the case of a student enrolled for Session 1 only or for both Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (23 April 1982). In the case of a student enrolled for Session 2 only this disbarment applies if any portion of fees is outstanding after the end of the sixth week of Session 2 (27 August 1982).

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

15. Fees

Tuition Fees

As a result of a decision of the Australian Government tuition fees have been re-introduced for some categories of students commencing second or higher degrees in 1982 and subsequent years. Details can be obtained from the office of the Admissions Section, telephone Mr J. Beauchamp on extension 3319.

University Union Entrance Fee

Payable on first enrolment \$25

Students enrolling for only one session must pay the full University Union entrance fee.

Student Activities Fees 1982

Student Activities fees are adjusted annually by a system of indexation. All students (with the exceptions set out in section 17, below) are required to pay the following fees if enrolled for a program involving two sessions. Those enrolling for only one session pay one half of the fees due.

University Union annual subscription \$65*

Sports Association annual subscription \$17

Students' Union Annual Subscription

Students enrolling in full-time courses \$17*

Students enrolling in part-time courses or as miscellaneous students \$13*

Miscellaneous Fund annual fee \$25*

This fee is used to finance expenses generally of a capital nature relating to student activities and amenities. Funds are allocated for projects recommended by the Student Affairs Committee and approved by the University Council.

Special Examination Fees

Examinations conducted in special circumstances for each subject \$11

Review of examination results for each subject \$11

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

Students who consider themselves eligible for life membership of the University Union, the Sports Association, or the Students' Union, should make enquiries about the matter at the offices of those bodies.

Students often seek exemption from the fees for reasons other than those set out in section 17, below. In this context it is necessary to be aware that the fees charged are a contribution by students towards services and amenities for the University community (both now and in the future) and exemption from them cannot be claimed because a student is unable or unwilling to make use of some of those services or amenities.

In addition to the fees outlined above and depending on the subject being taken, students may be required to make a payment for equipment; money so paid is, in general, refunded if the equipment is returned in satisfactory condition.

16. Penalties

(1) Failure to lodge enrolment form according to enrolment procedure \$20

(2) Payment of fees after end of second week of session \$20

(3) Payment of fees after end of fourth week of session \$40

Penalties (1) and (2) or (1) and (3) may accumulate.

17. Exemptions – Fees

Students often seek exemption from the fees for reasons other than those set out below. It is stressed that the fees charged are a contribution by students towards services and amenities for the University community (both now and in the future) and exemption from them cannot be claimed because a student is unable or unwilling to make use of some of those services or amenities.

(1) Life members of the University Union, the Sports Association, and Students' Union are exempt from the relevant fee or fees†.

(2) Students enrolled in courses classified as *External* are exempt from all Student Activities Fees and the University Union Entrance Fee.

(3) Students enrolled in courses at the W. S. and L. B. Robinson University College and in the Faculty of Military Studies are exempt from the fees in section 15, above but shall pay such other fees and charges as the Council may from time to time determine.

(4) University Union fees and subscriptions may be waived by the Deputy Registrar (Student Services) for students enrolled in graduate courses in which the formal academic requirements are undertaken at a part of the University away from the Kensington campus.

(5) Students who while enrolled at and attending another university (or other tertiary institution as approved by the Vice-Chancellor) in a degree or diploma course are given approval to enrol at the University of New South Wales but only as miscellaneous students for subjects to be credited towards the degrees or diplomas for which they are enrolled elsewhere are exempt from all Student Activities Fees and the University Union Entrance Fee**.

(6) Undergraduate students of a recognized university outside Australia who attend the University of New South

*These fees are at 1981 levels; they are subject to increase in 1982.

†Students who consider themselves eligible for life membership of the University Union, the Sports Association, or the Students' Union, should make enquiries about the matter at the offices of those bodies, not at the office of the Deputy Registrar (Student Services) or at the Cashier's office.

**Institutions approved are: New South Wales Institute of Technology, Sydney College of Chiropractic and Alexander Mackie College of Advanced Education.

Wales with the permission of the Dean of the appropriate faculty and of the Head of the appropriate school or department to take part as miscellaneous students in an academic program relevant to their regular studies and approved by the authorities of their own institution are exempt from all Student Activities Fees and the University Union Entrance Fee.

(7) Graduate students not in attendance at the University and who are enrolling in a project only other than for the first time, are exempt from all Student Activities Fees.

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

(9) All Student Activities Fees, for one or more sessions, may be waived by the Deputy Registrar (Student Services) for students who are given formal permission to pursue their studies at another institution for one or more sessions.

(10) Graduate students who have completed all the work for a qualification at the commencement of Session 1, except for the submission of the relevant thesis or project report, may be exempted from the payment of Student Activities Fees by the Deputy Registrar (Student Services) on production of an appropriate statement signed by the relevant Supervisor or Head of School.

(11) Students enrolled in a session or sessions devoted entirely to training or experience away from the campus and its associated laboratories, hospitals, centres, institutes, and field stations are exempt from all Student Activities Fees for that session or sessions.

(12) Students whose registration is cancelled or suspended by the University shall receive refunds of fees paid in accordance with the provisions of section 18. (5) below except that a refund of one half of the fees shall be made if such cancellation or suspension takes place between the end of the fourth week of Session 1 and the end of the fourth week of Session 2.

18. Variations in Enrolment (including Withdrawal)

(1) Students wishing to vary an enrolment program must make application on the form available from the appropriate Course Authority.

(2) Students withdrawing from courses (and see also information about withdrawal from subjects below) are required to notify the Registrar in writing. In some cases such students will be entitled to fee refunds (see below).

(3) Enrolment in additional subjects

Applications for enrolment in additional subjects must be submitted by:

26 March 1982 for Session 1 only and whole year subjects;

13 August 1982 for Session 2 only subjects.

(4) Withdrawal from subjects

Applications to withdraw from subjects may be submitted throughout the year but applications lodged after the following dates will result in students being regarded as having failed the subjects concerned, except in special circumstances:

(a) for one session subjects, the end of the seventh week of that session (16 April or 3 September)

(b) for whole year subjects, the end of the second week of Session 2 (30 July).

(5) Withdrawal from Course – Refunds

Whether or not a student's withdrawal entails academic penalties (covered in item (4) above) there are rules governing possible fee refunds in the case of complete withdrawal from a course, as follows:

(a) If notice of withdrawal from a course is received by the Registrar before the first day of Session 1, a refund of all fees paid will be made

(b) If notice of withdrawal is received on or after the first day of Session 1:

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

(ii) if the notice of withdrawal is given before the end of the fourth week of Session 1 (26 March 1982) a full refund of other Student Activities Fees paid will be made; if notice is given before the end of the eighth week of Session 1 (23 April 1982) a refund of one half of the other Student Activities Fees paid will be made; thereafter no refund will be made except that provided for in (iii) below.

(iii) if a student's enrolment in any year is for Session 2 only and the student gives notice of withdrawal prior to the end of the fourth week of Session 2 (13 August 1982) a full refund of Student Activities Fees paid (other than the University Union Entrance Fee for which see item (i) above) will be made; if notice is given before the end of the eighth week of Session 2 (10 September 1982) a refund of one half of the other Student Activities Fees paid will be made; thereafter no refund will be made.

(iv) The refunds mentioned in (ii) and (iii) above may be granted by the Deputy Registrar (Student Services) to a student unable to notify the Registrar in writing by the times required provided evidence is supplied that the student had ceased attendance by those times.

(6) Acknowledgements

The Registrar will acknowledge each application for a variation in enrolment (including withdrawals from subjects) as follows:

(a) variations lodged before the Friday of the seventh week of each session (16 April or 3 September) will be incorporated in the *Confirmation of Enrolment Program* notice forwarded to students on 26 April or 13 September as appropriate

(b) variations lodged after those dates will be acknowledged by letter

(c) withdrawals from a course are acknowledged individually whenever they are lodged.

(7) It is emphasized that failure to attend for any assessment procedure, or to lodge any material stipulated as part of an assessment procedure, in any subject in which a student is enrolled will be regarded as failure in that assessment procedure unless written approval to withdraw from the subject without failure has been obtained from the Registrar.

19. Exemption – Membership

The Registrar is empowered to grant exemption from membership of any or all of the University Union, the Students' Union and the Sports Association to students who have a genuine conscientious objection to such membership, subject to payment of the prescribed fees to the Miscellaneous Fund.

Private Overseas Students

Private overseas students should visit the Commonwealth Department of Education immediately on first arrival in Australia. The address is Sydney Plaza Building, 59 Goulburn Street, Sydney.

Private overseas students continuing their studies should confirm their enrolment with the Commonwealth Department of Education as early as possible each year in order to ensure that arrangements for the extension of their temporary entry permits can be made.

All private overseas students must advise the Department if they change their term residential address during the year. Telephone enquiries should be directed to (02) 218 8979, and country students may reverse the charge for the call.

Leave of Absence

Leave of absence from an undergraduate course of study may be granted to students other than those in the first year of a course. Leave of absence has generally been restricted to one year but in special circumstances two years have been granted.

To apply for such leave of absence, a letter should be submitted to the Registrar immediately following the

release of annual examination results and must include the student's full name, registration number, the course and stage in which enrolled in the previous year and, most important, the reason *why* leave is being sought. The letter advising the result of the application will provide details about how to re-enrol.

Students who withdraw from the first year of their course *are not* granted leave of absence and must again apply for a place through the Universities and Colleges Admissions Centre.

Course Transfers

Students wishing to transfer from one course to another must complete and submit an application form, obtainable from the office of the Admissions Section, the Chancellery, by Friday 8 January 1982.

Students whose applications to transfer are successful, and who are *transferring from one school to another* are required to comply with the enrolment procedure laid down for new students with advanced standing. *Students transferring from one course to another within the same school* are required to attend the appropriate enrolment session for the course to which they have approval to transfer.

Students must present the approval to transfer to the enrolling officer, and those who have not received advice regarding their application to transfer before the date on which they are required to enrol should check with the office of the Admissions Section.

Students should also advise the enrolling officer in the school in which they were enrolled in 1981 of their intention to transfer.

Admission with Advanced Standing

Any person who makes application to register as a candidate for any degree or other award granted by the University may be admitted to the course of study leading to such degree or award with such standing on the basis of previous attainments as may be determined by the Professorial Board provided that:

1. the Board shall not grant such standing under these rules as is inconsistent with the rules governing progression to such degree or award as are operative at the time the application is determined;

2. where a student transfers from another university such student shall not in general be granted standing in this University which is superior to what he has in the University from which he transfers;

3. the standing granted by the Board in the case of any application based on any degree/s or other awards already held by the applicant, shall not be such as will permit the applicant to qualify for the degree or award for which he seeks to register without completing the courses of instruction and passing the examinations in at least those subjects comprising the latter half of the course, save that where such a program of studies would involve the applicant repeating courses of instruction in which the Board deems the applicant to have already qualified, the Board may prescribe an alternative program of studies in lieu thereof;

4. the standing granted by the Board in the case of any application based on partial completion of the requirements for any degree or other award of another institution shall not be such as will permit the applicant to qualify for the degree or award for which he seeks to register by satisfactory completion of a program of study deemed by the Board to be less than that required of a student in full-time attendance in the final year of the course in which the applicant seeks to register;

5. the standing granted by the Board in the case of any application based on the partial completion of the requirements for any degree or other award of the University may be such as to give full credit in the course to which the applicant seeks to transfer for work done in the course from which the student transfers.

Where the identity between the requirements for any award of the University already held and that of any other award of the University is such that the requirements outstanding for the second award are less than half the requirements of that award, then a student who merely completes such outstanding requirements shall not thereby be entitled to receive the second award but shall be entitled to receive a statement over the hand of the Registrar in appropriate terms.

Resumption of Courses

Students who have had a leave of absence for twelve months and wish to resume their course should follow the instructions about re-enrolling given in the letter granting leave of absence. If these instructions are not fully understood or have been lost, students should contact the office of the Admissions Section before November in the year preceding the one in which they wish to resume their course.

If students have not obtained leave of absence from their course and have not been enrolled in the course over the past twelve months or more, they should apply for admission to the course through the Universities and Colleges Admissions Centre before 1 October in the year preceding that in which they wish to resume studies.

Examinations

Examinations are held in June/July and in November/December.

Provisional timetables indicating the dates and times of examinations are posted on the University noticeboards.

Students must advise the Examinations Section (the Chancellery) of any clash in examinations. Final timetables indicating the dates, times, locations, and authorized aids are available for students two weeks before the end of each session.

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

Assessment of Course Progress

In the assessment of a student's progress in a course, consideration may be given to work in laboratory and class exercises and to any term or other tests given throughout the year as well as to the results of written examinations.

Examination Results

Grading of Passes

Passes will be graded as follows:

<i>High Distinction</i>	an outstanding performance
<i>Distinction</i>	a superior performance
<i>Credit</i>	a good performance
<i>Pass</i>	an acceptable level of performance
<i>Satisfactory</i>	satisfactory completion of a subject for which graded passes are not available

Pass Conceded

A pass conceded may be granted to a student whose overall performance warrants consideration in a subject where the mark obtained is slightly below the standard required for a pass.

A pass conceded in a subject will normally allow progression to another subject for which the former subject is a prerequisite. In a particular subject, however, a subject authority may specify that a pass conceded is insufficient to meet a particular subject prerequisite. Such information is recorded in the appropriate faculty handbooks.

Availability of Results

Final examination results will be posted to a student's term address, or vacation address if requested. Forms requesting that results be posted to a vacation address are included in the examination timetable and change of address forms are obtainable at the Student Enquiry Counter, the Chancellery. Both forms can be accepted up to Friday 25 June for Session 1 results and Friday 26

November for Session 2 and whole year results. Results are also posted on School noticeboards and in the University Library. Results on noticeboards are listed by *Student Registration Number*.

No examination results are given by telephone.

Review of Results

A student may make application to the Registrar for the review of a result. The application form, accompanied by an appropriate fee, must be submitted not later than fifteen working days after the date of issue of the *Notification of Result of Assessment* form.

In reviewing a result, the subject authorities shall ensure that all components of the assessment have been assessed and a mark assigned.

A review of a result is not a detailed reassessment of a student's standard of knowledge and understanding of, and skills in, the subject. It is rather a search for arithmetic error in arriving at the composite mark and for gross and obvious error in assignment of marks in components of the final composite mark.

When a change in grade is recommended, the application fee will be refunded by the Registrar.

Special Consideration

Students who believe that their performance in a subject, either during session or in an examination, has been adversely affected by sickness or any other reason should inform the Registrar and ask for special consideration in the determination of their standing.

Such requests should be made as soon as practicable after the occurrence. Applications made more than seven days after the final examination in a subject will only be considered in exceptional circumstances.

When submitting a request for special consideration students should provide all possible supporting evidence (eg medical certificates) together with their registration number and enrolment details.

Physical Disabilities

Students suffering from a physical disability which puts them at a disadvantage in written examinations should advise Student Records (Ground Floor, the Chancellery) immediately their disability is known. If necessary, special arrangements will be made to meet the student's requirements.

Students who are permanently disabled and need the Examinations Section to make special arrangements for their examinations, should contact Student Records as soon as the final timetable becomes available.

Use of Electronic Calculators

Where the use of electronic calculators has been approved by a faculty or school, examiners may permit their use in examinations. Authorized electronic calculators are battery operated with the minimum operations of addition, subtraction, multiplication and division and are of a type in common use by university students. They are not provided by the University, although some schools may make them available in special circumstances.

Examinations Held Away from the Campus

Except in the case of students enrolled in external courses, examinations will not be permitted away from the campus unless the candidate is engaged on *compulsory industrial training*. Candidates must advise the Officer-in-charge, Examinations Section, immediately the details of the industrial training are known. Special forms for this purpose are available at the Student Enquiry Counter in the north wing of the Chancellery.

Arrival at Examinations

Examination Rooms will be open to students twenty-five minutes before the commencement of the examination. Candidates are requested to be in their places at least fifteen minutes before the commencement to hear announcements. The examination paper will be available for reading ten minutes before commencement.

Use of Linguistic Dictionaries

The answers in all examinations and in all work submitted must be in English unless otherwise directed. Students may apply for permission to use standard linguistic dictionaries in the presentation of written work for assessment. Such applications should be made in writing to the Examinations Section not later than 14 days prior to the need to use the linguistic dictionary.

Conduct of Examinations

Examinations are conducted in accordance with the following rules and procedure:

1. Candidates are required to obey any instruction given by an examination supervisor for the proper conduct of the examination.
2. Candidates are required to be in their places in the examination room not less than fifteen minutes before the time for commencement.
3. No bag, writing paper, blotting paper, manuscript or book, other than a specified aid, is to be brought into the examination room.
4. Candidates shall not be admitted to an examination after thirty minutes from the time of commencement of the examination.
5. Candidates shall not be permitted to leave the examination room before the expiry of thirty minutes from the time the examination commences.

6. Candidates shall not be re-admitted to the examination room after they have left it unless, during the full period of their absence, they have been under approved supervision.

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

8. All answers must be in English unless otherwise stated. Foreign students who have the written approval of the Registrar may use standard linguistic dictionaries.

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

10. A candidate who commits any infringement of the rules governing examinations is liable to disqualification at the particular examination, to immediate expulsion from the examination room and to such further penalty as may be determined in accordance with the By-Laws.

Acknowledgement of Sources

Students are expected to acknowledge the source of ideas and expressions used in submitted work. To provide adequate documentation is not only an indication of academic honesty but also a courtesy enabling the marker to consult sources with ease. Failure to do so may constitute plagiarism, which is subject to a charge of academic misconduct.

Further Assessment

In special circumstances further assessment including assessment or further assessment on medical or compassionate grounds may be granted.

Further assessment may be given by the subject authority at his or her discretion at any time prior to the meeting of the relevant faculty assessment committee (normally the fourth week of the Midyear Recess and the second week of December). Further assessment may also be awarded at the faculty assessment committee and students affected may need to be free to undertake that further assessment in the last week in the Mid-year Recess and in the period up to the end of the second week in January; students should consult their subject authority for details of further assessment immediately their results are known.

Restrictions upon Students Re-enrolling

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

First Year Rule

1. Students enrolled in the first year of any undergraduate course of study in the University shall be required to show cause why they should be allowed to continue the course if they do not pass the minimum number of subjects, units or credits prescribed for this purpose by the relevant faculty or board of studies.

The prescribed minimum for each undergraduate course may be found in Schedule A* below; the schedule may be varied from time to time by the Professorial Board.

Repeated Failure Rule

2. Students shall be required to show cause why they should be allowed to repeat a subject which they have failed more than once. Where the subject is prescribed as part of the course they shall also be required to show cause why they should be allowed to continue that course.

General Rule

3. (1) Students shall be required to show cause why they should be allowed to repeat a subject they have failed if the assessment committee of the faculty or board of studies so decides on the basis of previous failures in that subject or in a related subject. Where the subject is prescribed as part of the course they shall also be required to show cause why they should be allowed to continue their course.

(2) Students shall be required to show cause why they should be allowed to continue their course if the assessment committee of the faculty or board of studies so decides on the basis of their academic record.

The Session-Unit System

4. (1) Students who infringe the provisions of Rules 1. or 2. at the end of Session 1 of any year will be allowed to repeat the subject(s) (if offered) and/or continue the course in Session 2 of that year, subject to the rules of progression in the course.

(2) Such students will be required to *show cause* at the end of the year, except that students who infringe Rule 2. at the end of Session 1, and repeat the subjects in question in Session 2, and pass them, will not be required to *show cause* on account of any such subjects.

Exemption from Rules by Faculties

5. (1) A faculty or board of studies examinations committee may, in special circumstances, exempt students from some or all of the provisions of Rules 1. and 2.

(2) Such students will not be required to *show cause* under such provisions and will be notified accordingly by the Registrar.

Showing Cause

6. (1) Students wishing to *show cause* must apply for special permission to re-enrol. Application should be made on the form available from the Registrar and must be

*See Schedule A immediately below.

lodged with the Registrar by the dates published annually by the Registrar. A late application may be accepted at the discretion of the University.

(2) Each application shall be considered by the Admissions and Re-enrolment Committee of the relevant faculty or board of studies which shall determine whether the cause shown is adequate to justify the granting of permission to re-enrol.

Appeal

7. (1) Students who are excluded by the Admissions and Re-enrolment Committee from a course and/or subject under the provisions of the Rules will have their applications to re-enrol reconsidered automatically by the Re-enrolment Committee of the Professorial Board.

(2) Students whose exclusion is upheld by the Re-enrolment Committee may appeal to an Appeal Committee constituted by Council for this purpose with the following membership:

A Pro-Vice-Chancellor, nominated by the Vice-Chancellor who shall be Chairman.

The Chairman of the Professorial Board, or if its chairman is unable to serve, a member of the Professorial Board, nominated by the Chairman of the Professorial Board, or when the Chairman of the Professorial Board is unable to make a nomination, nominated by the Vice-Chairman.

One of the category of members of the Council elected by the graduates of the University, nominated by the Vice-Chancellor.

The decision of the Committee shall be final.

(3) The notification to students of a decision which has been upheld by the Re-enrolment Committee of the Professorial Board to exclude them from re-enrolling in a course and/or subject shall indicate that they may appeal against that decision to the Appeal Committee. The appeal must be lodged with the Registrar within fourteen days of the date of notification of exclusion; in special circumstances a late appeal may be accepted at the discretion of the Chairman of the Appeal Committee. In lodging such an appeal with the Registrar students should provide a complete statement of all grounds on which the appeal is based.

(4) The Appeal Committee shall determine appeals after consideration of each appellant's academic record, application for special permission to re-enrol, and stated grounds of appeal. In particular circumstances, the Appeal Committee may require students to appear in person.

Exclusion

8. (1) Students who are required to *show cause* under the provisions of Rules 1. or 3. and either do not attempt to *show cause* or do not receive special permission to re-enrol from the Admissions and Re-enrolment Committee (or the Re-enrolment Committee on appeal) shall be

excluded, for a period not in excess of two years, from re-enrolling in the subjects and courses on account of which they were required to *show cause*. Where the subjects failed are prescribed as part of any other course (or courses) they shall not be allowed to enrol in any such course.

(2) Students required to *show cause* under the provisions of Rule 2. who either do not attempt to *show cause* or do not receive special permission to re-enrol from the Admissions and Re-enrolment Committee (or the Re-enrolment Committee on appeal) shall be excluded, for a period not in excess of two years, from re-enrolling in any subject they have failed twice. Where the subjects failed are prescribed as part of a course they shall also be excluded from that course. Where the subjects failed are prescribed as part of any other course (or courses) they shall not be allowed to enrol in any such course.

Re-admission after Exclusion

9. (1) Excluded students may apply for re-admission after the period of exclusion has expired.

(2) (a) Applications for re-admission to a course should be made to the Universities and Colleges Admissions Centre before the closing date for normal applications in the year prior to that in which re-admission is sought. Such applications will be considered by the Admissions and Re-enrolment Committee of the relevant faculty or board of studies.

(b) Applications for re-admission to a subject should be made to the Registrar before 30 November in the year prior to that in which re-admission is sought. Such applications will be considered by the relevant subject authority.

(3) Applications should include evidence that the circumstances which were deemed to operate against satisfactory performance at the time of exclusion are no longer operative or are reduced in intensity and/or evidence of action taken (including enrolment in course/s) to improve capacity to resume studies.

(4) Applications for re-admission to a course or subject that are unsuccessful (see 9. (2) (a), (b) respectively) will be reconsidered automatically by the Re-enrolment Committee of the Professorial Board. The decision of the Re-enrolment Committee will be final.

10. Students who fail a subject at the examinations in any year or session and re-enrol in the same course in the following year or session must include in their programs of studies for that year or session the subject which they failed. This requirement will not be applicable if the subject is not offered the following year or session, 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.

Restrictions and Definitions

11. (1) These rules do not apply to students enrolled in programs leading to a higher degree or graduate diploma.

(2) A subject is defined as a unit of instruction identified by a distinctive subject number.

Schedule A

(See First Year Rule 1. above)

Where the minimum requirement is half the program, this is defined as half the sum of the unit values of all the subjects in the program where the unit value for each subject in a course is defined as follows:

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
Applied Science	Half the program	3000–3220 4190–4220	One-session subjects: UV 1 Two-session subjects: UV 2
Architecture	Half the program	3270, 3330 3310–3320 3360–3380	Elective subjects: UV 0 All other subjects: appropriate UV corresponding to credit points* Elective subjects: UV 0 All other subjects: UV equal to the allocated hours*
Arts	18 first level credit points	3400, 3410	
Biological Sciences	2 subjects (or their Science unit or Arts credit-point equivalent)	3430	
Commerce	Three subjects Two subjects	3490–3595 FT in both sessions 3490–3595 PT in either session	
Engineering	Half the program	3600–3750	One-session subjects: UV 1 Two-session subjects: UV 2
Law	Half the program	4710–4790	One-session subjects: UV 1 Two-session subjects: UV 2

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
Medicine	Half the program	3800	80.010: UV 3 80.001: UV 3 81.002: UV 6 70.001: UV 4 General Studies: UV 2
Military Studies	Half the program	BA, BSc BE	All subjects: UV 1 All subjects: appropriate weighted mark
Professional Studies	Half the program	4030, 4040 4060–4080	All subjects: UV 1 One-session subjects: UV 1 Two-session subjects: UV 2
Science	Half the program	3910, 3950	All subjects: appropriate UV* General Studies: UV 1
Science and Mathematics	Half the program	3970	All subjects: appropriate UV* General Studies: UV 1

Admission to Degree or Diploma

Students whose current program will enable them to complete all requirements for the degree or diploma, including industrial training where necessary, should lodge with the Registrar the form *Application for Admission to Degree/Diploma* and return it to the Registrar by the second Monday in May for the October ceremonies, and the first Tuesday in October for all other ceremonies. The forms are available from the Student Enquiry Counter in the north wing of the Chancellery.

Students who have indicated on their enrolment form that they are potential graduands are forwarded an application form with their Enrolment Details form in September (or, in the case of students who expect to satisfy requirements at

*For details see the appropriate Faculty Handbooks.

the end of Session 1, with the form issued in April). Students who do not complete an application form will not graduate; students who do not return their application form by the due date will graduate at a later series of ceremonies.

Students enrolled in courses 3400, 3910 and 3970 who have completed an application form to graduate at the pass level and who then decide to proceed to an honours year should advise the Registrar, in writing before 1 September for those completing requirements at the end of Session 1, or before 28 February for those completing requirements at the end of Session 2.

A list of graduands in Medicine who have applied for their degree is published in *The Sydney Morning Herald* in December.

A list of graduands other than Medicine who have applied for their degree/diploma and who expect to graduate in October is published in *The Sydney Morning Herald* on the second Wednesday in September.

A list of graduands other than Medicine who have applied for their degree/diploma and who expect to graduate in April/May the following year is published in *The Sydney Morning Herald* on the second Wednesday in March.

Students who are potential graduands and who wish to notify the Registrar of a change of address should submit an additional form *Final Year Students' Graduation: Change of Address*.

Attendance at Classes

Students are expected to be regular and punctual in attendance at all classes in the subjects in which they are enrolled. All applications for exemption from attendance at classes of any kind must be made in writing to the Registrar.

In the case of illness or of absence for some other unavoidable cause students may be excused by the Registrar for non-attendance at classes for a period of not more than one month or, on the recommendation of the Dean of the appropriate faculty, for a longer period.

Absence from Classes

Explanations of absences from classes, or requests for permission to be absent from forthcoming classes, should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If examinations or other forms of assessment have been missed, this should be stated in the application.

If students attend less than eighty per cent of their possible classes they may be refused final assessment.

Student Records

Confirmation of Enrolment Program notices are sent to all students on 26 April and 13 September. It is not necessary to return these forms unless any of the information recorded is incorrect. Amended forms must be returned to the Student Records and Scholarships Office within fourteen days. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Amended forms returned to the Registrar will be acknowledged in writing within fourteen days.

Release of Information to Third Parties

The University treats results of assessment and information it receives from a student as confidential and will not reveal such information to third parties without the permission of the student except at the discretion of senior officers in circumstances considered of benefit to the student and when it is either impossible or impracticable to gain the student's prior permission. This happens rarely. This policy is considered so important that it often involves officers of the University in very difficult situations, for example, when they must refuse to reveal the address of a student to parents or other relatives.

In spite of the policy, all students should be aware that students' addresses are eagerly sought by various commercial agents and that subterfuges of various kinds can be used to obtain them. From time to time, for example, people claiming to be from the University telephone students or their families and ask for information (usually another student's address) which is often given, unsuspectingly. There is evidence that this is a technique used by some commercial agents.

It would be generally helpful if students (and their families and friends) are cautious in revealing information, making it a practice to ask the name, position, and telephone extension of any caller claiming to be from the University and, if suspicious, returning the call to the extension given.

Change of Address

The Student Records and Scholarships Office of the Registrar's Division should be notified as soon as possible of any change of address. Failure to do this could lead to important correspondence (including results of assessment) going astray. The University cannot accept responsibility if official communications fail to reach students who have not given notice of their change of address. *Change of*

Address *Advice* Forms are available at Faculty and School offices and from the Student Enquiry Counter in the north wing of the Chancellery.

All communications from the University will be sent to the Session or Term address except when arrangements are made otherwise in the case of results of assessment (see Examinations: Availability of Results, earlier in this section). *Change of Address Advice* forms will be accepted up to Friday 26 November, except for final-year students wishing to change their *Application for Admission for Degree/Diploma* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

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.

Notices

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

Parking within the University Grounds

A limited amount of parking is available on campus. Copies of the University's parking rules may be obtained on application to Room 240, the Chancellery.

Academic Dress

Information about the University's academic dress requirements may be obtained from the Alumni and Ceremonials Section, Room 148E, the Chancellery (phone extension 2998).

Further Information

Lost Property

All enquiries concerning lost property should be made to the Superintendent on extension 3892 or to the Lost Property Office at the Union.

The Calendar

Please consult the Calendar for a more detailed account of the information contained in this section.

Vice-Chancellor's Official Welcome to New Students

All students initially enrolling in the University are officially welcomed by the Vice-Chancellor and Principal at the following times:

Full-time Students

In the Faculties of Architecture, Arts, Biological Sciences, Commerce, Law:

Thursday 25 February 1982
11 am in the Clancy Auditorium

In the Faculties of Applied Science, Engineering, Medicine, Professional Studies, Science, and the Board of Studies in Science and Mathematics:

Friday 26 February 1982
11 am in the Clancy Auditorium

Part-time Students

All courses:

Thursday 25 February 1982
6.30 pm in the Clancy Auditorium

Meeting for Parents of New Students

Friday 26 February 1982
7.30 pm in the Clancy Auditorium

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 well established in the Faculty are: Applied Geography (including Applied Economic Geography and Applied Physical Geography), Applied Geology, Chemical Engineering (including Biological Process Engineering and Fuel Engineering), Industrial Chemistry, Food Technology, Metallurgy (including Ceramic Engineering and Metallurgical Process Engineering), Mining Engineering, Textile Technology (including Textile Chemistry, Textile Physics, Textile Engineering and Textile Manufacture) and Wool and Pastoral Sciences. The Faculty is concerned with a variety of research programs and many of the Faculty's research contributions have achieved international recognition.

It is hoped that students who enter the Faculty will share the enthusiasm and the dedication of those who have taken part in its development. It is of the greatest importance that students should acquire, from the very beginning, the right approach to their studies, and that they should achieve a proper balance between their work and their extra-curricular activities.

In addition to this Handbook, pamphlets and brochures issued in conjunction with the enrolment period and Orientation Week are available. These should be consulted, together with the Calendar, for further information.

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

M. Chaikin
Dean
Faculty of Applied Science

Faculty Information

Who to Contact

If you require advice and information of a general nature contact:

Mr R. Starr, Senior Administrative Officer, Faculty of Applied Science. Room 123, Sir Robert Webster Building, Tel. 662 3401.

For information and advice of a specific nature, contact the appropriate school representative below:

Applied Geology Mr G. Baldwin, Senior Administrative Officer.

Room 810, Applied Science Building, Tel. 662 2336.

Chemical Engineering and Industrial Chemistry Mr J. Gatenby, Senior Administrative Officer.

Room 320, Applied Science Building, Tel. 662 2404.

Food Technology Mr R. Greenwood, Administrative Officer.

Room 411, Applied Science Building, Tel. 662 3816.

Geography Mr P. Dunkley, Administrative Assistant.

Room G10, Geography and Surveying, Tel. 662 2084.

Metallurgy Mr R. Ball, Senior Administrative Officer.

Room 110B, Metallurgy Building, Tel. 662 2351.

Mining Engineering Mr R. Rolls, Administrative Assistant.

Room 51B, Main Building, Tel. 662 2912.

Textile Technology Mr R. Starr, Senior Administrative Officer.

Room 123, Sir Robert Webster Building, Tel. 662 3401.

Wool and Pastoral Sciences Mr J. Lawrence, Administrative Officer.

Room 102, Wool and Pastoral Sciences Building, Tel. 662 2288.

Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1982 should obtain a copy of the free booklet *Enrolment Procedures 1982* available from School Offices and the Admissions Office. This booklet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Student Clubs and Societies

Students have the opportunity of joining a wide range of clubs and societies. Many of these are affiliated with the Students' Union. There are numerous religious, social and cultural clubs and also many sporting clubs which are affiliated with the Sports Association.

Clubs and societies seeking to use the name of the University in their title, or seeking University recognition, must submit their constitutions either to the Students' Union or the Sports Association if they wish to be affiliated with either of these bodies, or to the Registrar for approval by the University Council.

● **The Audio Visual Section**, containing cassette tapes, mainly lectures and other spoken word material. The Audio-Visual Section has wired study carrels and cassette players for student use.

Undergraduate Librarian Pat Howard

Applied Sciences Library Facilities

Although any of the university libraries may meet specific needs, the staff and students of the Faculty of Applied Science are served mainly by the Biomedical Library, Physical Sciences Library and the Undergraduate Library.

The Biomedical Library

This library serves the information needs of the staff and students of the Schools of Food Technology and Wool and Pastoral Sciences for life sciences aspects of their study and research.

Biomedical Librarian George Franki

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate students and senior undergraduate students in the areas of pure and applied science, engineering and architecture. The library's collection of books, serials and microforms bears the prefix 'P' and details of each item are included in the central monograph and serials catalogues. In addition, there is a map collection on Level 6. Journals with the prefix 'PJ' may not be borrowed. Trained staff are available at all times to assist readers with their enquiries.

Physical Sciences Librarian Marian Bate

The Undergraduate Library

This library caters for the library needs of first and second year students and other groups where large numbers require mass teaching.

The Undergraduate Library provides a reader education program and reader assistance service aimed at teaching students the basic principles of finding information.

Services of particular interest to undergraduates and academic staff are:

● **The Open Reserve Section**, housing books and other material which are required reading.

The Bachelor of Social Science Degree Course (3420)

The Bachelor of Social Science (BSocSc) is a new degree of special interest to students wishing to pursue careers in research, teaching, social planning and social administration. It enables students to gain a broad view of social issues, and introduces them to a diversity of social data. The program combines depth and breadth by requiring students to undertake a range of studies and to complete compulsory courses in the theories and methods of the various social sciences.

Although administered by the Faculty of Arts, the BSocSc degree course allows for in-depth study in two major disciplines drawn from various faculties. These disciplines are Economic History, Economics, Industrial Relations, Geography, History, History and Philosophy of Science, Mathematics, Philosophy, Political Science, Psychology, Sociology and Statistics.

It may be possible for a limited number of students who have completed a year of study in a faculty other than Arts to transfer into the second year stage of the course if their performance in at least two of the above disciplines is of a sufficiently high standard (credit level or better).

For further enquiries, contact the Arts Faculty Office, Room G1, Morven Brown Building, Tel. 662 2248.

Conditions for the Award of the Degree of Bachelor of Science or Bachelor of Engineering

The courses leading to the award of the degree of Bachelor of Science or Bachelor of Engineering in the Faculty of Applied

Science are normally programmed over four years of full time study. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the degree of Bachelor of Science or Bachelor of Engineering shall:

- (1) comply with the requirements for admission;
- (2) follow the prescribed course of study in the appropriate School, and satisfy the examiners in the necessary subjects;
- (3) complete an approved program of industrial or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty, but in each case must complete the appropriate period of approved industrial training before being eligible for the degree.

3. The degree shall be awarded in the pass or honours grade. Honours may be awarded in the following categories:

- Honours Class I
- Honours Class II, Division I
- Honours Class II, Division II

4. Students shall be required to conform with the general rules relating to University courses.

General Studies Program

Almost all undergraduates in Faculties other than Arts and Law are required to complete a General Studies program. The only course in the Faculty of Applied Science which does not have this requirement is the Bachelor of Science course in Economic Geography.

For further details, consult **General Information** earlier in this handbook.

Conditions for the Award of the Degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering)

The courses leading to the award of the degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering) in the Faculty of Applied Science are normally programmed over six years of part-time study in the University whilst the student is employed in industry. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the degree of BSc(Tech) or BSc(Eng) shall:

- (1) comply with the requirements for admission;
- (2) follow the prescribed course of study in the appropriate school and pass the necessary examinations;
- (3) complete an approved program of industrial or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty.

3. The degrees of BSc(Tech) and BSc(Eng) shall be awarded in the pass grade only but in the case of superior performance throughout the course the degree shall be conferred 'with merit'.

4. Students shall be required to conform with the general rules relating to University courses.

Undergraduate Study

Course Outlines

The Faculty of Applied Science consists of the Schools of Applied Geology, Chemical Engineering and Industrial Chemistry, Food Technology, Geography, Metallurgy, Mining Engineering, Textile Technology and Wool and Pastoral Sciences. These Schools offer full-time undergraduate courses leading to the degree of Bachelor of Science or Bachelor of Engineering, and some of the Schools also offer part-time courses leading to the award of the degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering).

Full-time Courses

Full-time courses of four years' duration leading to the award of the degree of Bachelor of Science are offered in Applied Geography, Applied Geology, Food Technology, Industrial Chemistry, Metallurgy, Textile Technology and Wool and Pastoral Sciences. Four-year courses leading to the award of the degree of Bachelor of Engineering are offered in Ceramic Engineering, Chemical Engineering, Metallurgical Process Engineering and Mining Engineering.

Honours: Candidates for honours are required to undertake special reading and other assignments as directed by the Head of the School concerned. In considering the award of honours special attention is paid to the performance of a candidate in the final research project, for which a thesis describing a theoretical or experimental study is required. Honours are awarded in Class I; Class II Division I; and Class II Division II.

Industrial Training Requirements: In the scientific and technological courses close association with industry is maintained on the practical aspects of the professions. This is achieved in most of the courses of the Faculty by expecting students to complete an approved industrial training program prior to graduation. This is normally carried out during the Summer Recess. In the case of Wool and Pastoral Sciences, students

are required to complete twenty-four weeks' approved practical work. In Mining Engineering students will undertake a program of practical training of at least 100 days.

Part-time Courses

Six-year, part-time courses leading to the award of the degree of Bachelor of Science (Technology) are offered by the School of Food Technology; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; in Metallurgy and Ceramic Engineering by the School of Metallurgy; and in Mineral Processing by the School of Mining Engineering (at Broken Hill only). The part-time Mining Engineering course leading to the award of the degree of Bachelor of Science (Engineering) is available at Broken Hill.

The BSc(Tech) degree courses are intended for students who are employed in relevant industries and who wish to prepare for a degree mainly by part-time attendance. As part of the requirements for the award of the BSc(Tech) degree, students are required to complete an approved program of industrial training of not less than one year prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School, may be completed after completion of the prescribed course of study.

Students who qualify for the award of the BSc(Tech) degree in the Faculty of Applied Science and who wish to proceed to the award of a BSc or BE degree will normally be required to complete further work which will involve at least one year of full-time attendance.

Holders of the degree of BSc(Tech) or BSc(Eng) will be eligible to proceed to the award of the degree of Master of Science, Master of Engineering or Master of Applied Science, subject to the regulations relating to these degrees.

Transfer is also possible from full-time courses to the part-time BSc(Tech) and BSc(Eng) degree courses, but in both cases a period of approved industrial experience must be gained before graduation. This requirement will apply to students transferring from BSc and BE degree courses within the Faculty.

BSc(Eng) Courses With Partial Full-time Attendance

BSc(Eng) degree courses may be completed by a combination of full-time and part-time study. The first two stages are to be completed part-time; in the following two years students complete the second and third years of the corresponding full-time course; and in the fifth stage a special program is prepared. Full details are set out below under the Schools which provide the courses.

School of Applied Geology

Head of School

Professor G. J. S. Govett

Senior Administrative Officer

Mr G. J. Baldwin

The structure and syllabus of the BSc degree course in Applied Geology are designed to prepare graduates for employment in some field of resource geology. Training to meet this objective demands a thorough understanding of basic geological principles; accordingly, in the early part of the course students receive instruction in standard fundamental geological subjects. As the course progresses, emphasis is increasingly placed on practical applications in engineering and environmental geology, mineral and energy deposits, and mineral exploration techniques including geological, geochemical and geophysical methods.

Attendance at the University for students taking the full-time professional course in Applied Geology is for twenty-eight weeks per year on the basis of two sessions of fourteen weeks each for four years. At least one session of the fourth year is devoted essentially to field and laboratory work on a specialized research project.

A three-year full-time course is available to students in the Faculty of Science, and provision is made for part-time study in the first year of geology within that Faculty. Selected students in the Faculty of Science may read for an honours degree in Geology.

Master of Applied Science degree courses in Engineering Geology, Hydrogeology, Environmental Geology, Mineral Exploration, Exploration Geochemistry and Exploration Geophysics are offered on a part-time or full-time basis. The courses are designed to provide specialized training in practical applications of these fields.

3000

Applied Geology — Full-time (New Course)

Bachelor of Science

BSc

Year 1

		Hours per week	
		S1	S2
1.001	Physics I or		
1.011	Higher Physics	6	6
2.121	Chemistry IA and		
2.131	Chemistry IB	6	6
10.001	Mathematics I or		
10.011	Higher Mathematics I or		
10.021B	General Mathematics IB and		
10.021C	General Mathematics IC	6	6
25.110	Earth Materials and Processes*	6	0
25.120	Earth Environments and Dynamics*	0	6
		24	24

*Up to 2 days of field tutorials in 25.110 Earth Materials and Processes and up to 4 days in 25.120 Earth Environments and Dynamics are essential parts of these subjects. Attendance is compulsory.

Year 2

25.211	Earth Materials I*	6	0
25.212	Earth Environments I**	6	0
25.221	Earth Materials II***	0	6
25.223	Earth Physics****	0	6
	General Studies Elective	1½	1½
		13½	13½

Students take Ancillary Subjects for a total of not less than 10 hpw. Subjects are selected preferably from the following list. Other subjects, however, may be taken conditional on approval of the Head of School.

Ancillary Subjects

2.002A	Physical Chemistry	6	or	6
2.002C	Inorganic Chemistry	6	or	6
5.010	Engineering A	6	or	6
5.020	Engineering B	6	or	6
10.031	Mathematics	2		2
10.301	Statistics SA or			
10.331	Statistics SS	2		2
15.001	Microeconomics I	3½	or	3½
15.011	Macroeconomics I	3½	or	3½
17.021	Biology of Higher Organisms	0		6
17.031	Cell Biology	6		0

*Field work of up to one day is a compulsory part of the subject.

**Field work of up to five days is a compulsory part of the subject.

***Field work of up to eight days is a compulsory part of the subject.

****Field work of up to one day is a compulsory part of the subject.

Year 3

		S1	Hpw	S2
25.311	Earth Materials III	6		0
25.321	Earth Materials IV*	0		6
25.312	Earth Environments II	6		0
25.313	Exploration and Data Processing**	6		0
25.314	Mineral and Energy Resources I***	6		0
25.324	Mineral and Energy Resources II****	0		6
25.325	Engineering and Environmental Geology†	0		6
25.326	Geological Techniques‡	0		6
	General Studies Electives	3		3
		27		27

*Field work of up to six days is a compulsory part of the subject.

**Field work of up to five days is a compulsory part of the subject.

***Field work of up to four days is a compulsory part of the subject.

****Field work of up to one day is a compulsory part of the subject.

†Field work of up to three days is a compulsory part of the subject.

‡Field work of up to ten days is a compulsory part of the subject.

Year 4

25.411	Resource Geology**	8½	4
and either			
25.412	Mineral and Energy Resources†	12½	20
or			
25.413	Engineering and Environmental Resources	12½	20
	General Studies Elective	3	0
		24	24

**Field work of up to ten days duration is a compulsory part of this subject.

†May include all or some combination of the following subjects as determined by the Head of School:

- 7.013 Principles of Mining
- 7.023 Mineral Process Engineering
- 7.214 Mine Economics and Planning

School of Chemical Engineering and Industrial Chemistry

Head of School

Professor D. L. Trimm

Senior Administrative Officer

Mr J. R. Gatenby

The former Schools of Chemical Engineering and Chemical Technology were amalgamated in January 1980 to form the combined School of Chemical Engineering and Industrial Chemistry. The new school offers the courses previously taught

by the former two schools, ie a course in Chemical Engineering and a course in Industrial Chemistry. The combined school contains the Departments of Chemical Engineering and Industrial Chemistry which service the two degree courses, and the Departments of Biological Process Engineering, Fuel Technology and Polymer Science which offer options in these degree courses.

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

Biological process engineering is the extension of chemical engineering principles to systems involving biological materials. Typical areas of interest are: the manufacture of antibiotics; the fermentation industries; bacterial mineral extraction; and the production of industrially useful materials by the growth and utilization of micro-organisms.

Fuel engineering is primarily concerned with the practical and economic applications of scientific knowledge and engineering experience to the production, processing and utilization of fuels and energy.

Industrial Chemistry is the discipline in which the scientific work of the research chemist is translated into the activities of the chemical industry. The thermodynamic feasibility of a reaction in inorganic or organic chemistry, the conditions under which the reaction might proceed, the kinetics of the reaction and the means whereby the reaction might be controlled to produce the desired product are the fundamentals of the course.

For the award of honours in both the Chemical Engineering and Industrial Chemistry degree courses, students need to have distinguished themselves in the formal work, in other assignments as directed by the Head of the School, and in the final year project, for which a thesis is required.

It is compulsory that before completion of the course students in the full-time course in Chemical Engineering must obtain a minimum of twelve weeks' professionally oriented, or industrial experience. Students in the part-time courses in Chemical Engineering should complete three years of industrial training concurrently with their University work.

It is recommended that before graduation students in the full-time courses in Industrial Chemistry obtain a minimum of eight weeks' professionally oriented or industrial experience. Students in the part-time courses in Industrial Chemistry must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

3040

Chemical Engineering — Full-time Course

Bachelor of Engineering

BE

This course extends over four years and students study full-time during the day for twenty-eight weeks of each year (excluding examination and recess periods).

Successful completion of the BE degree course is accepted by the Institution of Chemical Engineers, the Institution of Engineers, Australia, and the Royal Australian Chemical Institute as sufficient academic qualification for corporate membership.

It may also qualify graduates for membership of the Australian Institute of Energy and the Institute of Energy (UK).

Plus one of the following electives:

	Hpw	
	S1	S2
44.101 ** Introductory Microbiology	6	0
48.039 Chemical Engineering IJ	3	3
48.321 Fuel Engineering	3	3
Any other elective approved by Head of School		

**Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Year 1

		Hours per week	
		S1	S2
1.001	Physics I or		
1.011	Higher Physics I	6	6
2.121	Chemistry IA and		
2.131	Chemistry IB or	6	6
2.141	Chemistry IM	6	6
5.010	Engineering A	6	0
5.030	Engineering C	0	6
	(includes 48.001 Introduction to Chemical Industry)		
10.001	Mathematics I or		
10.011	Higher Mathematics I	6	6
		24	24

Year 4**

48.041	Chemical Engineering IIIA	4	0
48.042	Chemical Engineering IIIB	4	0
48.043	Chemical Engineering IIIC	5	0
48.044	Chemical Engineering Laboratory II	3	0
	Advanced Chemical Engineering Electives	0	6
	Project*	1	11
	General Studies Elective	1½	1½
		18½	18½

Plus one or more of the following to a total of 6 hrs/week for 28 weeks:

Year 2

		Hours per week	
		S1	S2
2.002A	Physical Chemistry	6	0
6.832	Electrical Machines	0	3
8.112	Structures	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.021	Chemical Engineering IA	5	0
48.022	Chemical Engineering IB	0	5
48.311	Fuel Engineering I*	2	2
48.121	Corrosion in Chemical Industry	0	2
48.122	Instrumental Analysis	0	6
	Two General Studies Electives	3	3
		23	25

*In certain cases this subject may be replaced by another elective with approval of the Head of School.

Year 3

2.002B	Organic Chemistry	6	0
10.032	Mathematics	2	2
48.031	Chemical Engineering IIA	7	0
48.032	Chemical Engineering IIB	0	6
48.033	Chemical Engineering IIC	0	6
48.036	Chemical Engineering Laboratory I	2	2
48.135	Thermodynamics	3	0
48.136	Reactor Design I	0	3
48.163	Instrumentation and Process Control I	0	3
	General Studies Elective	1½	1½
		21½	23½

		Hpw	
		S1	S2
4.121	Principles of Metal Extraction	3	3
7.314	Mineral Process Technology	3	3
18.551	Operations Research	3	3
23.051	Nuclear Power Technology	3	3
48.040	Chemical Engineering Projects	6	6
48.0461	Introductory Reservoir Engineering	2	0
48.0462	Advanced Reservoir Engineering	0	2
48.211	Biological Process Engineering	6	6
48.331	Fuel Engineering III	6	6
Any other elective approved by Head of School***			

*The project is to be selected from:

- 48.040 Chemical Engineering Projects
- 48.240 Biological Process Engineering Project
- 48.340 Fuel Engineering Project

**This course will be revised for 1983.

***Advanced Chemical Engineering Electives may be included to bring hours per week to six.

Chemical Engineering — Subjects and Units

		Hpw	
		S1	S2
48.001	Introduction to Chemical Industry	0	2
48.021	Chemical Engineering IA		
	Unit 1 Flow of Fluids	2	0
	2 Material and Energy Balances	2	0
	3 Dimensions	1	0
		5	0

		Hours per week				Hpw	
		S1	S2			S1	S2
48.022	Chemical Engineering IB Unit 1 Heat Transfer I 2 Computations 1 3 Pumps and Pumping	0 0 0	2 2 1	48.033	Chemical Engineering IIC Unit 1 Mass Transfer Design 2 Heat Transfer II (Design) 3 Process Vessels 4 Fluid-Particle Systems	0 0 0 0	1½ 1 1½ 2
		0	5			0	6
48.023	Chemical Engineering Science I — (Applicable to Science programs) Consists of: 48.021 and 48.022			48.036	Chemical Engineering Laboratory I Unit 1 2	2 0	0 2
		5	5			2	2
48.024	Chemical Engineering Principles I (Applicable to Mathematics programs) Consists of: Units 1 and 3 of 48.021 and Unit 1 of 48.022			48.037	Chemical Engineering Science II (Applicable to Science programs) Consists of: Units 1, 2 and 5 of 48.031, Unit 2 of 48.032, Unit 4 of 48.033 48.135 and 48.136		
		3	2			7	7
48.025	Chemical Engineering for Chemical Technologists Consists of: Units 1 and 2 of 48.021 and Units 1 and 2 of 48.022			48.038	Chemical Engineering Principles II (Applicable to Mathematics programs) Consists of: Units 1, 2 and 5 of 48.031 and Unit 4 of 48.033		
		4	4			4	2
48.031	Chemical Engineering IIA Unit 1 Mass Transfer (theory) 2 Heat Transfer II (theory) 3 Plant Layout 4 Process Engineering 5 Surface Separation Processes 6 Economics I	2 1 1 1 1 1	0 0 0 0 0 0	48.039	Chemical Engineering IIJ	3	3
		7	0	48.041	Chemical Engineering IIIA Unit 1 Convective Mass Transfer 2 Simultaneous Heat and Mass Transfer 3 Multicomponent Separation 4 Transport Phenomena	1 1 1 1	0 0 0 0
48.032	Chemical Engineering IIIB Unit 1 Solids Handling 2 Computations II 3 Engineering Thermodynamics 4 Economics II 5 Safety and Failure Tolerance	0 0 0 0 0	1 2 1 1 1			4	0
		0	6	48.042	Chemical Engineering IIIB Unit 1 Process Dynamics II 2 Control I 3 Optimization	1 2 1	0 0 0
						4	0

		Hours per week	
		S1	S2
48.043	Chemical Engineering IIIC		
	Unit 1 Design Workshop	3	0
	2 Industrial Pollution Control	2	0
		5	0

48.044	Chemical Engineering Laboratory II	3	0
--------	------------------------------------	---	---

Advanced Chemical Engineering Electives

48.0451	Plant Layout II	0	2
48.0452	Chemical and Phase Equilibria	0	2
48.0453	Control II	0	2
48.0454	Reactor Engineering	0	2
48.0455	Fluid-Particle Systems II	0	2
48.0456	Process Engineering II	0	2
48.0457	Oil and Gas Processing	2	0

Students are to select 6 session hours only. It is hoped that some of the above electives will be offered in Session 1.

48.040	Chemical Engineering Projects	1	11
48.0461	Introductory Reservoir Engineering	2	0
48.0462	Advanced Reservoir Engineering	0	2
48.135	Thermodynamics	3	0
48.136	Reactor Design I		
	Unit 1 Reaction Engineering	0	2
	2 Kinetics of Rate Processes	0	1
		0	3

48.163	Instrumentation and Process Control	0	3
48.211	Biological Process Engineering	6	6
48.240	Biological Process Engineering Project	1	11

48.311	Fuel Engineering I*		
	Unit 1 Fuels and Energy — Sources and Properties	1	0
	2 Energy Conversion	0	1
	3 Fuel Processing	1	0
	4 Fuel Plant Technology	0	1
		2	2

*Two units each session, but are interchangeable.

		Hpw	
		S1	S2
48.321	Fuel Engineering II*		
	Unit 1 Combustion — Fundamentals and Science	0	1
	2 Principles of Gasification	0	1
	3 Radiation Heat Transfer and Application	1	0
	4 Measurements in Flames and Furnaces	1	0
	5 Laboratory — Fuel Testing	1	1
		3	3

*Laboratory programmed as 9 x 3 hour periods. Two lecture units each session are interchangeable.

48.331	Fuel Engineering III		
	Unit 1 Combustion Engineering	1	0
	2 Furnace Design	1	0
	3 Fuel Plant Design	0	1
	4 Fuel Conservation and Efficiency	0	1
	5 Liquid Fuels	0	1
	6 Coal and its Evaluation	1	0
	7 Laboratory	3	3
		6	6

48.340	Fuel Engineering Project	1	11
--------	--------------------------	---	----

3040 Chemical Engineering — Full-time/Part-time Course Bachelor of Engineering BE

The BSc(Tech) degree course in Chemical Engineering was replaced in 1975 by a part-time/full-time course leading to the award of a BE degree normally to be completed in seven years. The preferred course pattern is as follows:

Stages 1 and 2 or Year I
Stages 3 and 4 or Year II
Stages 5 and 6 or Year III
Stage 7 or Year IV

Various course patterns involving full-time/part-time study may be approved by the Head of the School.

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

Preferred course pattern for BSc(Tech) and BE degree courses — Full-time/Part-time

For variations to this course pattern students should contact the School.

Stage 1

	Hours per week	
	S1	S2
1.001 Physics I or		
1.011 Higher Physics I	6	6
10.001 Mathematics I or		
10.011 Higher Mathematics I	6	6
	12	12

Stage 2

2.121 Chemistry IA and		
2.131 Chemistry IB or	6	6
2.141 Chemistry IM	6	6
5.010 Engineering A	6	0
5.030 Engineering C	0	6
(Includes 48.001 Introduction to Chemical Industry)		
	12	12

Stage 3

2.002A Physical Chemistry	6	0
10.031 Mathematics	2	2
10.301 Statistics SA	2	2
48.122 Instrumental Analysis	0	6
General Studies Elective	1½	1½
	11½	11½

Stage 4

6.832 Electrical Machines	0	3
8.112 Structures	3	0
48.021 Chemical Engineering IA	5	0
48.022 Chemical Engineering IB	0	5
48.121 Corrosion in Chemical Industry	0	2
48.311 Fuel Engineering I*	2	2
General Studies Elective	1½	1½
	11½	13½

*In certain cases this subject may be replaced by another elective with approval of Head of School.

Stage 5*

	Hpw	
	S1	S2
10.032 Mathematics	2	2
48.031 Chemical Engineering IIA	7	0
48.032 Chemical Engineering IIB	0	6
48.135 Thermodynamics	3	0
48.136 Reactor Design I	0	3
48.163 Instrumentation and Process Control	0	3
General Studies Elective	1½	1½
	13½	15½

Stage 6*

2.002B Organic Chemistry	6	0
48.033 Chemical Engineering IIC	0	6
48.036 Chemical Engineering Laboratory I	2	2
General Studies Elective	1½	1½
	9½	9½

Plus one of the following electives:

44.101 Introductory Microbiology**	6	0
48.039 Chemical Engineering IIJ	3	3
48.321 Fuel Engineering II	3	3
Any other elective approved by Head of School		

**Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Stage 7*

As per Year 4 of full-time course.

*This course will be revised for 1983.

3100 Industrial Chemistry — Full-time Course Bachelor of Science BSc

Year 1

	Hours per week	
	S1	S2
1.001 Physics I	6	
or		
1.011 Higher Physics	6	
2.121 Chemistry IA and		
2.131 Chemistry IB	6	
or		
2.141 Chemistry IM	6	
10.001 Mathematics I	6	
or		
10.011 Higher Mathematics	6	

Plus:

25.011**Geology I	6
or	
5.010 Engineering A* and	6
5.030 Engineering C*†	6
or	
17.031**Cell Biology* and	6
17.021**Biology of Higher Organisms*	6
	<hr/>
	24
	<hr/>

*One session only.

†Industrial Chemistry students take 48.001 Introduction to Chemical Industry in 5.030.

**Students are expected to attend a specified part of 48.001 Introduction to Chemical Industry.

Year 2

	Hpw	
	S1	S2
2.002A Physical Chemistry	6	0
2.042C Inorganic Chemistry	0	6
2.002B Organic Chemistry	6	0
6.851 Electronics and Instrumentation	3	0
10.031 Mathematics	2	2
10.301 Statistics SA	2	2
48.122 Instrumental Analysis	0	6
48.125 Industrial Chemistry IA	4	0
48.126 Industrial Chemistry IB	0	4
General Studies Elective	1½	1½
	<hr/>	<hr/>
	24½	21½
	<hr/>	<hr/>

Year 3

2.030 Organic Chemistry	6	0
48.113 Chemistry of Industrial Processes	3	3
48.121 Corrosion in the Chemical Industry	0	2
48.135 Thermodynamics	3	0
48.136 Reactor Design I	0	3
48.137 Industrial Chemistry IIA	3	0
48.138 Industrial Chemistry IIB	0	3
48.139 Experimental Design	0	2
48.163 Instrumentation and Process Control I	0	3
48.171 Chemistry of High Temperature Materials	0	2
48.172 Instrumental Analysis II	3	0
48.403 Polymer Science	3	3
Two General Studies Electives	3	3
	<hr/>	<hr/>
	24	24
	<hr/>	<hr/>

Year 4*

	Hpw	
	S1	S2
18.121 Production Management	3	3
48.114 Processes	0	2
48.124 Applied Kinetics	3	0
48.134 Applied Thermodynamics	2	0
48.154 Process Simulation	3	1
48.164 Instrumentation and Process Control II	5	0
48.174 Seminars	3	3
48.184 Process Analysis	2	2
48.194 Project (Industrial Chemistry)	6	8
General Studies Elective	1½	1½
	<hr/>	<hr/>
	28½	20½
	<hr/>	<hr/>

With the approval of the Head of School, students may substitute either 48.414 Polymer Chemistry and 48.424 Physical Chemistry of Polymers II or 48.434 Polymer Physics II for 48.114 Processes.

*This course will be revised for 1983.

3110 Industrial Chemistry — Part-time Course Bachelor of Science (Technology) BSc(Tech)

Stages 1 and 2*

	Hours per week
1.001 Physics I or	6
1.011 Higher Physics I	6
2.121 Chemistry IA and	
2.131 Chemistry IB or	6
2.141 Chemistry IM	6
10.001 Mathematics I or	
10.011 Higher Mathematics I	6
Plus:	
25.011 Geology I**	6
or	
5.010 Engineering A† and	6
5.030 Engineering C†§	6
or	
17.031 Cell Biology†** and	6
17.021 Biology of Higher Organisms†**	6

*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.

†One session only.

§Industrial Chemistry students take 48.001 Introduction to Chemical Industry in 5.030.

**Students are expected to attend a specified part of 48.001 Introduction to Chemical Industry.

Stage 3

		Hours per week	
		S1	S2
2.002A	Physical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	0	6
	General Studies Elective	1½	1½
		11½	11½

Stage 4

2.002B	Organic Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
6.851	Electronics and Instrumentation	3	0
48.125	Industrial Chemistry IA	4	0
48.126	Industrial Chemistry IB	0	4
	General Studies Elective	1½	1½
		14½	11½

Stage 5

48.121	Corrosion in the Chemical Industry	0	2
48.135	Thermodynamics	3	0
48.136	Reactor Design I	0	3
48.137	Industrial Chemistry IIA	3	0
48.138	Industrial Chemistry IIB	0	3
48.139	Experimental Design	0	2
48.171	Chemistry of High Temperature Materials	0	2
48.172	Instrumental Analysis II	3	0
	General Studies Elective	1½	1½
		10½	13½

Stage 6

2.003B	Organic Chemistry	6	0
48.113	Chemistry of Industrial Processes	3	3
48.163	Instrumentation and Process Control I	0	3
48.403	Polymer Science	3	3
	General Studies Elective	1½	1½
		13½	10½

Options in Course 3040 Chemical Engineering**Chemical Engineering**

Students wishing to pursue a career in the chemicals, petroleum, petrochemical, minerals utilization or metallurgical

industries are advised to take 48.039 Chemical Engineering IJ in Year 3 and relevant options (additional Advanced Chemical Engineering Electives, Reservoir Engineering, Principles of Metal Extraction or Mineral Process Technology) together with the 48.040 Chemical Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree.

Fuel Engineering

The Department of Fuel Technology offers a coherent option in Fuel Engineering designed for those students wishing to pursue a career concerned with fuel and energy conversion and the application of fossil fuels to the process industries. The Department is the only one of its kind in Australia and has a long history of teaching and research in the fossil fuels area. The electives comprising the option cover the broad areas of properties, constitution, processing and conversion, and utilization of fossil fuels. Topics include combustion science and engineering; radiation and flames; design and performance evaluation of fuel using plant such as furnaces, boilers and heat recovery appliances; coal and oil conversion processes; energy conservation; and progress in fuel science and fuel processing. Students electing for this option should take 48.321 Fuel Engineering II in Year 3 and 48.331 Fuel Engineering III and 48.340 Fuel Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree.

Biological Process Engineering

The Department of Biological Process Engineering offers a coherent option in Biological Process Engineering designed for students wishing to pursue a career in the biologically based processing industries. Students electing for this option should take 44.101 Introductory Microbiology in Year 3, and 48.211 Biological Process Engineering and 48.240 Biological Process Engineering Project in Year 4.

Options in Course 3100 Industrial Chemistry**Polymer Science**

The Department of Polymer Science offers an elective strand in polymer chemistry and physics to students undertaking course 3100 Industrial Chemistry. Students electing for this strand should take 48.414 Polymer Chemistry and 48.424 Physical Chemistry of Polymers II or 48.434 Polymer Physics II in Year 4.

Permission of the Head of School is required.

School of Food Technology

Head of School

Professor R. A. Edwards

Administrative Officer

Mr R. J. Greenwood

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

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

The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods by optimum processes and equipment. Foods are studied in terms of their basic constituents and the changes they undergo when subjected to modern processing and distribution. The technologist is equally concerned with the development and selection of raw materials from agricultural, horticultural, animal and marine sources.

There is a demand, both national and international, for professionally trained people who are prepared to accept responsibility for the quality and safety of man's food supply, who can contribute to the solution of one of the greatest problems of our age, how to make food supplies grow faster than population.

The School of Food Technology offers a four-year full-time course leading to the award of the degree of Bachelor of Science and six-year part-time course leading to the award of the degree of Bachelor of Science (Technology). Graduates of both courses qualify for membership of the Royal Australian Chemical Institute, the Australian Institute of Food Science and Technology, and the US Institute of Food Technologists.

A Graduate Diploma course in Food Technology of one year full-time or two years' part-time is designed for graduates in science or agriculture wishing to familiarize themselves with the principles of food technology.

3060

Food Technology — Full-time Course

Bachelor of Science BSc

This course is designed to provide depth and breadth in the relevant physical and biological sciences on which food

technology is based. Students completing the Year 1 requirements are eligible for selection for admission to Year 2 of the course.

Year 1

	Hours per week	
	S1	S2
1.001 Physics I or		
1.021 Introductory Physics I	6	6
2.121 Chemistry IA and		
2.131 Chemistry IB	6	6
10.001 Mathematics I or		
10.011 Higher Mathematics I or	6	6
10.021B General Mathematics IB and	6	0
10.021C General Mathematics IC	0	6
17.021 Biology of Higher Organisms	0	6
17.031 Cell Biology	6	0
	24	24

Year 2

2.002A Physical Chemistry	0	6
2.002B Organic Chemistry	0	6
2.002D Analytical Chemistry	0	6
38.122 Man and Food	1	0
38.421 Food Engineering I	0	3
38.521 Introductory Nutrition	3	0
41.101 Introductory Biochemistry	12	0
44.143 Microbiology AS	10	0
General Studies Elective	0	3
	26	24

Year 3

2.043L Chemistry and Enzymology of		
Foods	6	6
10.301 Statistics SA	2	2
38.131 Principles of Food Preservation	4	0
38.132 Plant Food Science	0	3
38.133 Animal Food Science	0	2
38.134 Food Science Laboratory	6	6
38.135 Food Quality Assessment	0	3
38.331 Food Microbiology I	3	0
38.431 Food Engineering II	3	0
General Studies Elective	0	3
	24	25

Year 4*

38.140 Food Technology Project	8	8
38.141 Food Regulation and Control	4	0
38.146 Inspections	0	3
38.147 Food Quality Assessment	0	2
Two General Studies Electives	3	3
	15	16

*Year 4 is currently being revised.

Plus two or more of the following electives to a total of not less than 8½ hrs/week.

		Hours per week	
		S1	S2
2.003B	Organic Chemistry	0	6
18.121	Production Management	3	3
18.551	Operations Research	3	3
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
38.142	Oenology	6	0
38.143	Cereal Technology	6	0
38.144	Treatment and Utilization of Food Processing Wastes	0	3
38.145	Marine Products Technology	2	0
38.148	Communications in Food Science and Nutrition	3	0
38.341	Food Microbiology II	0	6
38.344	Yeast Technology	0	3
38.442	Food Engineering III	6	0
38.541	Advanced Nutrition	3	0
38.542	Special Topics in Nutrition	0	3
38.543	Field and Laboratory Methods in Nutrition	0	3
42.102A	Biotechnology A	6	0
42.102B	Biotechnology B	0	6

or such other electives, to a total of not less than 8½ hrs/week, as approved by the Head of School.

During the second, third and fourth years of the course excursions are made to various food industries. Detailed reports of some of these visits are required.

Detailed reports of the students' activities during their periods in industry are required.

3070 Food Technology — Part-time Course Bachelor of Science (Technology) BSc(Tech)

This course is designed for students who are employed in the food processing industries. It extends over six part-time years of study, and leads to the award of the degree of Bachelor of Science (Technology). Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School may be completed after completion of the prescribed course of study.

The course covers the same subject matter as the first three years of the full-time course. For the first two years students follow a common course in which general biology is taken, and thereafter specialize in the biological sciences, which are fundamental to the study of food science and technology. The subjects of Stages 4, 5 and 6 may be available only in day-time

classes, and substantial day-time release from industry may be required.

Students who have completed the requirements of this course and have qualified for the award of the degree of Bachelor of Science (Technology) may proceed to the award of 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 the award of a BSc degree must apply to the Head of the School not later than 31 December of the year in which the sixth stage is completed.

Stages 1 and 2*

		Hours per week	
		S1	S2
1.001	Physics I or		
1.021	Introductory Physics I	6	6
2.121	Chemistry IA and		
2.131	Chemistry IB	6	6
10.001	Mathematics I or	6	6
10.011	Higher Mathematics I† or		
10.021B	General Mathematics IB and	6	0
10.021C	General Mathematics IC	0	6
17.021	Biology of Higher Organisms	0	6
17.031	Cell Biology	6	0

*Physics and Mathematics are usually taken as Stage 1, the other subjects as Stage 2.

†There are no evening lectures in this subject.

Stage 3

2.002B	Organic Chemistry	0	6
2.002D	Analytic Chemistry	0	6
41.101	Biochemistry	12	0
	General Studies Elective	1½	1½
		13½	13½

Stage 4

2.002A	Physical Chemistry	0	6
38.122	Man and Food	1	0
38.421	Food Engineering I	0	3
38.521	Introductory Nutrition	3	0
44.143	Microbiology AS	10	0
	General Studies Elective	0	3
		14	12

Stage 5

2.043L	Chemistry and Enzymology of Foods	6	6
10.301	Statistics SA	2	2
38.135	Food Quality Assessment	0	3
38.431	Food Engineering II	3	0
	General Studies Elective	1½	1½
		12½	12½

Stage 6

		Hours per week	
		S1	S2
38.131	Principles of Food Preservation	4	0
38.132	Plant Food Science	0	3
38.133	Animal Food Science	0	2
38.134	Food Science Laboratory	6	6
38.331	Food Microbiology I	3	0
		13	11

There are elective specializations in physical geography (with special emphasis on either the biologic or geomorphic aspects), and in economic geography (with emphasis on urban geography). First year courses involve systematic studies of the physical or economic bases of geography. There is progressive specialization in the following years, but the course in physical geography has 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.

All students are expected to spend a period of four to six weeks with organizations concerned with the investigation and planned use of resources *et cetera*.

Several units in Geography include laboratory and project work involving the use of quantitative techniques. Students need a battery-operated calculator; advice on appropriate machines may be obtained from the School Office. It is also required that students provide their own drawing materials such as tracing and graph paper. Details of exact requirements are given at the beginning of the relevant subjects.

School of Geography

Head of School
Professor J. A. Mabbutt

Administrative Assistant
Mr P. Dunkley

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 and environmental assessment, and economic geographers are engaged as urban and regional planners and spatial analysts.

Applied Geography — Full-time Courses Bachelor of Science

The School offers two four-year full-time courses leading to the award of the degree of Bachelor of Science, which aim to train professional geographers for entry into applied fields.

3010 Applied Geography — Full-time Course Bachelor of Science BSc

Applied Physical Geography

Year 1

		Hours per week	
		S1	S2
10.021B	General Mathematics IB and	6	0
10.021C	General Mathematics IC or	0	6
10.001	Mathematics I or	6	6
10.011	Higher Mathematics I	0	6
17.021	Biology of Higher Organisms	0	6
17.031	Cell Biology	6	0
25.110	Earth Materials and Processes†	6	0
25.120	Earth Environments and		
	Dynamics†	0	6
27.111	Applied Physical Geography I*	6	6
		24	24

†Up to 1½ days of field tutorials in 25.110 and up to 3½ days in 25.120 are essential parts of these subjects. Attendance is compulsory.

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

Year 2

		Hpw	
		S1	S2
2.121	Chemistry IA or	6	0
2.111	Introductory Chemistry	6	0
2.131	Chemistry IB	0	6
27.162	Geographical Statistics and Computing	4	2
27.172	Environmental Measurements*	6	6
	Two General Studies Electives	3	3
	and either		
25.211	Earth Materials I and	6	0
25.221	Earth Materials 2†	0	6
	or any two of the following (one each session)		
43.111	Flowering Plants	6	0
43.101	Introductory Genetics	0	6
43.121	Plant Physiology	0	6
45.152	Population and Community Ecology‡	6	0
45.201	Invertebrate Zoology	0	6
45.301	Vertebrate Zoology	6	or 6
		24	24

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

†Field work of up to 3 days, equivalent to 7 tutorial hours is an essential part of this subject.

‡May be taken in either Second or Third Year. 10.001 or 10.011 is a prerequisite.

Year 3

27.133	Pedology*	5	0
27.143	Biogeography*	0	5
27.153	Climatology	0	5
27.163	Methods in Physical Geography	1	1
27.173	Remote Sensing Applications	3	0
27.183	Geomorphology*	5	0
27.193	Environmental Impact Assessment	1½	0
	Two General Studies Electives	3	3
	and either		
25.510	Geology for Geomorphologists and Pedologists and	0	5
25.622	Hydrological and Coastal Surveying	3	3
	or any two of the following (one each session)		
43.142	Environmental Botany	6	0
43.112	Plant Taxonomy§	0	6
43.152	Plant Community Ecology	0	6
43.162	The Plant Kingdom§	0	6
45.121	Evolutionary Theory	6	0
45.152	Population and Community Ecology†	6	0
45.302	Vertebrate Zoogeography	0	6
		21½	22
		or 24½	20

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

§Offered in alternate years.

†May be taken in either Year 2 or Year 3. 10.001 or 10.011 is a pre-requisite.

Year 4

		Hpw	
		S1	S2
27.194	Assessment and Management of Physical and Biological Resources*	12	0
27.504	Project†	6	16
27.514	Practical Applications in Geography	0	3
		18	19

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

†Includes scheduled tutorials of one hour per week in Session 1 and two hours per week in Session 2.

Applied Economic Geography

Year 1

		Hpw	
		S1	S2
10.021B	General Mathematics IB and	6	0
10.021C	General Mathematics IC or	0	6
10.001	Mathematics I or		
10.011	Higher Mathematics I	6	6
15.001	Microeconomics I	3½	0
15.011	Macroeconomics I	0	3½
27.611	Applied Economic Geography I*	6	3
27.631	Geographic Data Analysis I	0	4
54.1001	Political Science I	4	4
		19	20

*Three days' field work, equivalent to 24 tutorial hours, is an essential part of the subject.

Year 2

15.002	Microeconomics II or	4	0
15.072	Economics IIE†	4	0
15.042	Macroeconomics II or	0	4
15.062	Economics IID†	0	4
27.612	Applied Economic Geography IIA*	6	0
27.622	Applied Economic Geography IIB	0	6
27.632	Geographic Data Analysis II	3	3
27.642	Mathematical Methods for Spatial Analysis	3	3

27.652	Geographic Information Systems	0	3
27.662	Urban and Regional Systems**	4	0
54.008	Public Policy Making	3	0
		20	22

*Three days' field work, equivalent to 24 tutorial hours, is an essential part of the subject.

†May be taken in either Session 1 or Session 2.

**Not offered in 1982.

Year 3

27.633	Geographic Data Analysis III	6	6
27.613	Applied Economic Geography IIIA	4	0
27.623	Applied Economic Geography IIIB*	0	4

Plus six of the following, at least two subjects from economics and at least two subjects from geography**:

15.003	Macroeconomics III	4	0
15.043	Marxian Political Economy	3	0
15.053	Economic Development	0	3
15.073	Natural and Environmental Resources Economics	0	3
15.082	Labour Economics	3	0
15.083	Public Finance	0	3
15.093	Public Sector Economics	3	0
15.143	Microeconomics III	0	4
15.163	Industrial Organisation and Policy	3	0
24.003G	Theory of Land Use/Transport Interaction†	3	0
24.013G	Transport Economics†	0	4
27.713	Marketing Geography†	0	4
27.723	Transport Geography†	0	4
27.733	Regional Policy and Planning†	4	0
27.743	Regional Population Analysis†	4	0
27.753	Social Welfare and Urban Development†	4	0
27.763	Rural Resource Problems†	0	4
27.773	Spatial Aspects of the Housing Market†	4	0
27.783	Spatial Impacts and Opportunities†	4	0
27.793	Models of Spatial Systems†	4	0
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
		21	21

*Three days' field work, equivalent to 24 tutorial hours, is an essential part of the subject.

†Subject to the availability of staff in 1982.

**Up to two subjects may be substituted for those listed with permission of Head of School.

‡By arrangement with Heads of Schools.

Year 4

27.504	Project*	10	15
27.514	Practical Applications in Geography	0	3
27.624	Geographic Thought and Perspectives	3	0
27.644	Seminars in Applied Geography	4	0
		17	18

*Includes scheduled tutorials of one hour per week in Session I and two hours per week in Session 2

Geography in Other Faculties

Courses in Geography are available on a full-time basis in the Faculties of Arts, Commerce and Science.

School of Metallurgy

Head of School
Professor H. Muir

Senior Administrative Officer
Mr R. A. Ball

The School of Metallurgy consists of the Departments of Chemical and Process Metallurgy, Physical and Industrial Metallurgy, Materials, and Ceramic Engineering. It offers courses in Metallurgy, Metallurgical Process Engineering and Ceramic Engineering.

Metallurgy and Metallurgical Process Engineering

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.

Graduate metallurgists have a wide choice of type of employment and location. They may work in production, technical control or development, either in the ore treatment or metal extraction plants in locations such as Newcastle, Port Kembla, Broken Hill, Mt. Isa, Townsville, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in the metal manufacturing plants, including the automobile, aircraft, construction 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 people. If the graduates are inclined towards research and development, they 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. There are three undergraduate courses, two full-time in Metallurgy and in Metallurgical Process Engineering, leading to the award of the BSc and the BE degree respectively; and one part-time in Metallurgy, leading to the award of the BSc(Tech) degree. The aim of the BE degree course is to prepare graduates for employment in the mineral, metallurgical and manufacturing industries as metallurgical process engineers.

The BSc and BE degree courses are almost identical up to third year and students enrolled in either of these courses may transfer from one to the other up to this point without loss of standing.

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 Australasian Institute of Metals and the undergraduate Metallurgical Society of the University, all of which students are encouraged to join, may be obtained from the Head of the School. It is expected that submissions to the Institution of Engineers for recognition of the Bachelor of Engineering degree course will meet with success.

3120 Metallurgy — Full-time Course

Bachelor of Science BSc

Students in this course attend the University for twenty-eight weeks over two sessions from March to November (excluding examinations and recesses).

Students are required, before graduation, to have gained at least sixteen weeks approved industrial experience, and to have submitted satisfactory reports on the work done to comply with this requirement. Industrial experience is normally obtained during the long vacations at the end of second and third years. During the second, third, and fourth years of the course, visits are made to various metallurgical works, and students are required to submit reports on some of these.

Year 1

		Hours per week
1.001	Physics I or	6
1.011	Higher Physics I	6
2.121	Chemistry IA (Session 1) and	
2.131	Chemistry IB (Session 2)	6
10.001	Mathematics I or	
10.011	Higher Mathematics I	6

Plus either:

5.010	Engineering A and	
5.030	Engineering C†	6

or

25.110	Earth Materials and Processes and	
25.120	Earth Environments and Dynamics	6
		<hr/> 24

†Metallurgy students take 4.002 Introduction to Metallurgical Engineering in 5.030.

Year 2

	S1	S2
2.002A	Physical Chemistry	6
4.302	Chemical and Extraction Metallurgy I	3
4.402	Physical Metallurgy I	6
4.502	Mechanical Metallurgy	4
4.602	Metallurgical Engineering I	0
4.802	Metallurgical Physics	0
10.031	Mathematics	2
5.010	Engineering A† and	2
5.030	Engineering C† or	0
25.541	Mineralogy	2
	General Studies Elective	1½
		<hr/> 24½
		<hr/> 24½

†Part only.

Year 3

	S1	S2
4.303	Chemical and Extraction Metallurgy II	5
4.403	Physical Metallurgy II	9
4.613	Metallurgical Engineering IIA	3
4.703	Materials Science	0
4.813	Mathematical Methods	3
6.854	Electrical Machinery and Supply	0
7.023	Mineral Process Engineering	2
	Two General Studies Electives	3
		<hr/> 25
		<hr/> 27

Year 4

		Hpw	
		S1	S2
4.024	Metallurgy Project*	6	3
4.054	Metallurgy Seminar	2	2
4.314	Chemical and Extraction Metallurgy IIIA	4½	0
4.324	Chemical and Extraction Metallurgy IIIB	0	4½
4.404	Physical Metallurgy III	7½	4½
4.504	Mechanical and Industrial Metallurgy	3	9
	General Studies Elective	1½	1½
		24½	24½

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

3180

Metallurgical Process Engineering — Full-time Course

Bachelor of Engineering
BE

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

Year 1

		Hours per week	
		S1	S2
1.001	Physics I or	6	6
1.011	Higher Physics I	6	6
2.121	Chemistry IA and		
2.131	Chemistry IB	6	6
5.010	Engineering A and	6	0
5.030	Engineering C†	0	6
10.001	Mathematics I or		
10.011	Higher Mathematics I	6	6
		24	24

†Students in Metallurgical Process Engineering take 4.002 Introduction to Metallurgical Engineering in 5.030.

Year 2

2.002A	Physical Chemistry	6	0
4.302	Chemical and Extraction Metallurgy I	3	3
4.402	Physical Metallurgy I	6	6
4.502	Mechanical Metallurgy	4	3
4.602	Metallurgical Engineering I	0	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
25.541	Mineralogy	2	2
	General Studies Elective	1½	1½
		24½	24½

Year 3

		Hours per week	
		S1	S2
4.303	Chemical and Extraction Metallurgy II	5	5
4.433	Physical Metallurgy IIC	9	6
4.613	Metallurgical Engineering IIA	3	0
4.623	Metallurgical Engineering IIB	0	4
4.813	Mathematical Methods	3	3
6.854	Electrical Machinery and Supply	0	4
7.313	Minerals Engineering Processes	3	3
	Two General Studies Electives	3	3
		26	28

Year 4

4.054	Metallurgy Seminar	2	2
4.314	Chemical and Extraction Metallurgy IIIA	4½	0
4.504	Mechanical and Industrial Metallurgy	3	9
4.604	Metallurgical Engineering III	6	9
4.624	Metallurgical Engineering Project*	3	3
	General Studies Elective	1½	1½
		20	24½

Plus any combination of the following electives giving a total of at least 63 hours over the year (28 weeks):

		Hpw	
		S1	S2
4.414	Physical Metallurgy IIIA	4½	0
6.851	Electronics and Instrumentation	3	0
7.314	Mineral Process Technology	3	3
15.501	Introduction to Industrial Relations	2	0
48.032	Chemical Engineering IIB — Unit 1 Solids Handling	0	1
	Unit 4 Economics II	0	1
	Unit 5 Safety and Failure Tolerance	0	1
48.0455	Advanced Chemical Engineering Elective — Fluid Particle Systems II	0	2

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

3130

Metallurgy — Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

This course is designed for students who are employed in the metallurgical industries. It extends over six part-time years of

study, and leads to the award of the degree of Bachelor of Science (Technology). Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School may be completed after completion of the prescribed course of study.

Stages 1 and 2*

	Hours per week
1.001 Physics I	6
2.121 Chemistry IA and	
2.131 Chemistry IB	6
5.010 Engineering A and	
5.030 Engineering C	6
10.001 Mathematics I or	
10.011 Higher Mathematics I†	6

*The Physics and Mathematics subjects are taken in Stage 1, and the other subjects in Stage 2.

†There are no evening lectures in this subject.

Stage 3

	S1	S2
2.002A Physical Chemistry	6	0
4.312 Chemical and Extraction Metallurgy IA	1	5
4.802 Metallurgical Physics	0	2
10.031 Mathematics	2	2
Two General Studies Electives	3	3
	12	12

Stage 4

	6	6
4.402 Physical Metallurgy I	4	0
4.512 Mechanical Properties of Solids	0	5
4.602 Metallurgical Engineering I	2	2
25.541 Mineralogy		
	12	13

Stage 5

	0	2
4.000 Metallurgy Special Topics	9	6
4.433 Physical Metallurgy IIC	0	3
4.522 Mechanical Metallurgy	3	0
6.851 Electronics and Instrumentation	1½	1½
General Studies Elective		
	13½	12½

Stage 6

	3	3
4.034 Industrial Metallurgy Project	2	2
4.054 Metallurgy Seminar	3	3
4.514 Industrial Metallurgy	3	0
4.613 Metallurgical Engineering IIA	3	3
4.813 Mathematical Methods	0	3
6.855 Electrical Power Utilization		
	14	14

Ceramic Engineering

The ceramic industry produces an enormous volume and variety of products used in engineering applications, building construction and in our everyday life. As well as the traditional bricks, roof tiles, sheet and container glass and tableware, ceramics have been found essential as abrasives, refractories, enamels and in electrical and electronic applications and nuclear fuels. In many of these cases, ceramic articles make possible the manufacture of other products either by being a key component, such as an electronic or magnetic part, or by forming the material of construction of, for example, a blast furnace or an abrasive wheel.

Modern ceramics comprise such a varied and complex group of materials that a high level of training is required to control their manufacture with the required precision and to supervise their proper use. Ceramic engineers are needed in increasing numbers both in Australia and overseas countries and the Department offers the only degree course in Ceramic Engineering in Australasia. The Ceramic Engineering course trains students in the relation between the structure and the properties of ceramic materials, the engineering and process chemistry of their manufacture and the design principles of their use. Careers open to graduates fall into two broad categories. Some go initially into activities associated directly with production, ie the design and layout of plants, supervision of their construction, and control of their operations. Others move into research and development in industrial laboratories or research institutions. In either case, graduates with organizing ability frequently move into management if they have an interest in this side of the industry.

In Australia, a number of government research organizations are active in ceramic research, eg the Australian Atomic Energy Commission Research Establishment, and the Divisions of Materials Science and Building Research of CSIRO. Investigations with more immediate applications are carried out in industrial laboratories. Even when the basic principles of a process have been worked out in the laboratory, its successful transfer to an industrial scale requires a great deal of effort and expertise. This is an area which offers great scope for further development in Australia.

Graduates in Ceramic Engineering are eligible for membership of the Institution of Engineers, Australia, the Institute of Ceramics (Great Britain) and the Royal Australian Chemical Institute.

3020

Ceramic Engineering — Full-time Course

Bachelor of Engineering BE

Year 1

	Hours per week
	S1 S2
1.001 Physics I	6 6
2.121 Chemistry IA and	
2.131 Chemistry IB	6 6

		Hpw	
		S1	S2
5.010	Engineering A	0	6
5.030	Engineering C†	6	0
10.001	Mathematics I or		
10.011	Higher Mathematics I	6	6
		24	24

†Ceramic Engineering students take 4.231 Introduction to Ceramic Engineering in 5.030.

Year 2

1.9322	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
4.232	Ceramic Engineering I	0	3
4.961	Materials and Corrosion	0	2
6.851	Electronics and Instrumentation	3	0
8.112	Structures	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
	General Studies Elective	1½	1½
		23½	19½

Year 3

4.213	Chemical Ceramics	6	5
4.233	Ceramic Process Principles	3½	3½
7.023	Mineral Process Engineering	2	0
25.541	Mineralogy	2	2
48.0212	Material and Energy Balances*	2	0
48.025	Chemical Engineering for Ceramic Engineers	3	3
48.135	Thermodynamics	3	0
48.163	Instrumentation and Process Control I	0	3
48.311	Fuel Engineering I	2	2
	General Studies Elective	1½	1½
		25	22

*Additional 14 hours bridging course for students not having done 48.001.

Year 4

4.224	Physical Ceramics	6	6
4.234	Ceramic Engineering II	4	4
4.294	Project (Ceramic Engineering)	6	9
	Two General Studies Electives	3	3
18.131	Operations Research	0	3
48.164	Instrumentation and Process Control II	5	0
		24	25

3030 Ceramics — Part-time Course Bachelor of Science (Technology) BSc(Tech)

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.121	Chemistry IA and	
2.131	Chemistry IB	
5.010	Engineering A**	6
5.030	Engineering C**§	6
10.001	Mathematics I or	6
10.011	Higher Mathematics I†	6

*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.

**One session only.

§Ceramics students take 4.231 Introduction to Ceramic Engineering in 5.030.

†There are no evening lectures in this subject.

Stage 3

		S1	S2
1.9322	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	6	0
6.851	Electronics and Instrumentation	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
		13	7

Stage 4

2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
4.232	Ceramic Engineering I	0	3
4.961	Materials and Corrosion	0	2
8.112	Structures	3	0
	General Studies Elective	1½	1½
		10½	12½

Stage 5

4.233	Ceramic Process Principles	3½	3½
7.023	Mineral Process Engineering	2	0
48.0212	Material and Energy Balances*	2	0
48.025	Chemical Engineering for Ceramic Engineers	3	3
48.163	Instrumentation and Process Control I†	0	3
	General Studies Elective	1½	1½
		13	11

*Additional 14 hrs bridging course for students not having done 48.001.
†Laboratories operate for 3 hour periods in alternate weeks.

Stage 6

		Hpw	
		S1	S2
4.213	Chemical Ceramics	6	5
25.541	Mineralogy	2	2
48.135	Chemical Thermodynamics	3	0
48.311	Fuel Engineering I	2	2
	General Studies Elective	1½	1½
		13½	12½

School of Mining Engineering

Head of School

Professor F. F. Roxborough

Administrative Assistant

Mr R. Rolls

Australia is one of the world's largest producers of minerals and, with vast reserves of metallic ores, coal and diverse other minerals, the mining industry of this country is assured of a long and prosperous future. Mining, whether underground, at the surface or on the ocean floor has become a technically advanced activity and education for mining engineers has progressed rapidly to cater for present day and future requirements of the industry. Mining engineers are now front-line executives: they plan, co-ordinate and control the many activities which comprise the operations of a mine. They are in control of all phases of mining projects from the initial planning and development to mineral extraction and processing and final restoration of the land.

To prepare graduates for these tasks, the School of Mining Engineering provides an education in a wide range of engineering topics and associated scientific subjects, at the same time providing a comprehensive insight into the techniques and practices of modern mining, mineral processing and mine management.

The School offers a 4 year full-time course in Mining Engineering leading to the award of the degree of Bachelor of Engineering (pass or honours) and a graduate course requiring one year of full-time or two years of part-time study leading to the award of the Graduate Diploma (GradDip) in Mining and Minerals Engineering.

Part-time courses are conducted at the W. S. & L. B. Robinson University College, Broken Hill — in Mining Engineering leading to the award of the BE degree and in Mineral Processing leading to the award of the BSc(Tech) degree. It is also possible to take the BE degree course at Broken Hill as a full-time student.

After graduation, mining engineers are equipped to enter any sector of the mining industry such as coal mining, metalliferous mining, petroleum production, sea-floor mining, quarrying or mineral processing. If they choose to develop careers in production management, they will be required to gain further practical experience before obtaining a Mine Managers Certificate of Competency, in either Coal or Metalliferous Mining. These statutory certificates of competency are issued by the State Government Department of Mines, which in the case of New South Wales coal mining comes under the *Coal Mines Regulation Act No. 37, 1912*, and for metalliferous mining under the *Mines Inspection Act No. 75, 1901*.

Graduate mining engineers are not, however, restricted to primary production for employment. Many find posts in civil sub-surface construction; research and development; with consultants, governments or universities; or with their broad engineering training, in a wide range of manufacturing industries.

Arrangements have been made with the Universities of Newcastle and Tasmania for students who have completed a specified program at these institutions to be admitted with advanced standing to Year 3 of the Mining Engineering degree course at the University of New South Wales.

3140

Mining Engineering — Full-time Course

Bachelor of Engineering

BE

The first year of the course is essentially the same as that for several other Engineering courses and second year includes those subjects of common relevance to the Engineering disciplines. The third year is largely devoted to basic mining subjects and the fourth year provides advanced instruction in subjects essential to all mining engineers. In addition, the fourth year offers a wide range of elective subjects, allowing students, if they so wish, to concentrate their studies on a particular sector of the industry, such as coal mining or metalliferous mining. An important fourth year requirement is for students to undertake a personal research or study project in mining or minerals engineering on which they are required to submit a thesis for examination.

For the award of Honours at the conclusion of the full-time course, students will need to have distinguished themselves in the formal work, in other assignments as directed by the Head of School, and in the final year project.

In the undergraduate course it is compulsory for students to gain practical experience in the mining industry during successive long recesses. The minimum requirement is 100 days which must be completed before graduation. The School assists students in securing suitable vacation employment. Students are required to submit for assessment an industrial training report on the vacation and other relevant experience acquired.

Year 1

		Hours per week	
		S1	S2
1.001	Physics I	6	6
2.951	Chemistry I (ME)	0	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
5.030	Engineering C†	6	0
10.001	Mathematics I or		
10.011	Higher Mathematics I	6	6
		24	24

†Incorporates 7.111, Introduction to Mining Engineering. Visits to mines and related undertakings are a requirement of this subject.

Year 2

4.972	Materials for Mining Engineers	1½	1½
6.851	Electronics and Instrumentation	3	0
6.855	Electrical Power Utilization	0	4
7.142	Mine Development†	1	1
7.132	Fluid Mechanics and Machines	2	2
8.172	Mechanics of Solids II	4	0
8.250	Properties of Materials	2	2
10.022	Engineering Mathematics II	4	4
10.301	Statistics SA	1½	1½
29.441	Surveying for Engineers	0	6
25.520	Geology for Mining Engineers‡	2	2
	General Studies Elective	1½	1½
29.491	Survey Camp	0	0
		22½	25½

†Visits to mines and related undertakings are a requirement of this subject.

‡Includes two compulsory field tutorials.

Year 3

7.113	Mining Methods†	2	2
7.123	Geomechanics	3	3
7.133	Mine Transport	0	2½
7.143	Mine Environment and Safety Engineering‡	3½	3½
7.153	Power Supply in Mines	2½	0
7.163	Excavation Engineering	2	2
7.173	Computer Applications in Mining	2	2
7.213	Mine Surveying	2	0
7.313	Minerals Engineering Processes	3	3
25.521	Geology for Mining Engineers II§	4	4
	General Studies Elective	1½	1½
		25½	23½

†Visits to mines and related undertakings are a requirement of this subject.

‡Includes field training in mine-rescue and recovery.

§A geology field excursion is held at the end of Session 1.

Year 4

		Hpw	
		S1	S2
4.974	Mining Materials	1	0
7.114	Geotechnical Engineering	3	3
7.174	Mining Legislation	1	1
7.214	Mine Economics and Planning	4	4
7.224	Operational Management	2	2
7.414	Minerals Industry Project	1	1
7.424	Industrial and Research Seminars	1	1
	Two General Studies Electives	3	3
		25	24

together with an approved grouping† of 3 subjects selected from the following

4.374	Metal Extraction Processes	3	3
7.124	Coal Face Mechanization*	6	0
7.134	Metalliferous Mining Systems*	3	3
7.144	Surface and Offshore Mining	0	6
7.154	Petroleum Engineering	3	3
7.164	Tunnel Engineering	3	3
7.314	Mineral Process Technology	3	3
48.301	Fuel Engineering	3	3
		25	24

†Approval for a group of subjects must be obtained from the Head of School and must include at least one of the subjects marked *

4200

Mining Engineering — Part-time Course

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

The School of Mining Engineering offers a part-time course in Mining Engineering at Broken Hill. The course is presented as a six-stage enrolment and there is provision for acceleration by a combination of full and part-time study.

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

4200

Mining Engineering — Part-time Course

**Bachelor of Engineering
BE**

Stage 1

		Hours per week	
		S1	S2
2.121	Chemistry IA	6	0
5.030	Engineering C	0	6

		Hpw	
		S1	S2
7.142R	Mine Development	1	1
10.001	Mathematics I	6	6
	General Studies Elective	1½	1½
		14½	14½

Stage 2

1.001	Physics I	6	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
25.520	Geology for Mining Engineers*	2	2
		14	14

*Excursions will be necessary.

Note: Not all options are offered in Engineering A, B and C.

Stage 3

5.422	Mechanics of Solids II/ Materials	4½	4½
7.113R	Mining Methods	3	3
10.022	Engineering Mathematics II	4	4
29.441	Surveying for Engineers	3	3
29.491	Survey Camp†	(40 class contact hours)	
		14½	14½

†Candidates with sufficient practical experience in a mine survey office may be excused from the camp.

Stage 4

5.622	Fluid Mechanics/ Thermodynamics	4	4
6.851R	Electronics and Instrumentation	3	0
6.852R	Electrical Machinery and Supply	0	3
7.123R	Geomechanics	3	3
10.351	Statistics SM	1½	1½
25.112R	Geology for Mining Engineers IIA	2	2
	General Studies Elective	1½	1½
		15	15

Stage 5

7.133R	Mine Transport	0	2½
7.153R	Power Supply in Mines	2½	0
7.163R	Excavation Engineering	1½	1½
7.213R	Mine Surveying	1	1
7.224R	Operational Management	1½	1½
7.313R	Mineral Processing	5	5
25.122R	Geology for Mining Engineers IIB	2	2
	General Studies Elective	1½	1½
		15	15

Note: A mining excursion of one week is necessary in either Stage 5 or 6.

Stage 6

		Hpw	
		S1	S2
4.972	Materials for Mining Engineers	1½	1½
7.114R	Geotechnical Engineering	2	2
7.143R	Mine Environment and Safety Engineering	2½	2½
7.214R	Mine Economics and Planning	3	3
7.414R	Minerals Industry Project	4	4
7.424R	Feasibility Studies and Seminars	2	2
		15	15

4210

Mining Engineering — Part-time Course*

Bachelor of Science (Engineering) BSc(Eng)

*This course is being progressively discontinued.

Stage 5

		Hours per week	
		S1	S2
7.123R	Geomechanics	3	3
7.133R	Mine Transport	0	2½
7.153R	Power Supply in Mines	2½	0
7.163R	Excavation Engineering	1½	1½
7.213R	Mine Surveying	1	1
7.224R	Operational Management	1½	1½
25.112R	Geology for Mining Engineers IIA	2	2
	Two General Studies Electives	3	3
		14½	14½

Note: A mining excursion of one week is necessary in either Stage 5 or Stage 6.

Stage 6

7.114R	Geotechnical Engineering	2	2
7.143R	Mine Environment and Safety Engineering	2½	2½
7.313R	Mineral Processing	5	5
7.416R	Minerals Industry Project	2	2
25.122R	Geology for Mining Engineers IIB	2	2
		13½	13½

4190
Mining Engineering — Full-time Program
W. S. and L. B. Robinson University College,
Broken Hill
Bachelor of Engineering
BE

Year 1

As course 4200.

Year 2

As course 4200. Mine visits are necessary in conjunction with subject 7.113R Mining Methods.

Year 3 and Year 4

As course 4200, *plus*,
in Year 3 — Subject No. 7.193R Mine Technology, and
in Year 4 — Subject No. 7.194R Mine Design Practice.
In addition at least 100 days of practical experience must be
gained before graduation.

Stage 2

		Hours per week	
		S1	S2
1.001	Physics I	6	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
25.201R	Mineragraphic Laboratory Work	1	0
25.520	Geology for Engineers I	2	2
		15	14

Stage 3

2.002A	Physical Chemistry	6	0
5.030	Engineering C	0	6
7.113R	Mining Methods	3	3
10.022	Engineering Maths II	4	4
	General Studies Elective	1½	1½
		14½	14½

Stage 4

2.042C	Inorganic Chemistry	6	0
2.002D	Analytical Chemistry	0	6
4.972R	Materials for Mining Engineers	1½	1½
5.343	Linear Systems Analysis	3	0
5.344	Feedback Control	0	3
5.422	Mechanics of Solids II/ Materials	4½	4½
		15	15

4220
Mineral Processing — Part-time Course
W. S. and L. B. Robinson University College,
Broken Hill
Bachelor of Science (Technology)
BSc(Tech)

This course is designed to meet the requirements of students
who are employed by the mineral processing industries. It
extends over six part-time years of study and leads to the
award of the degree of Bachelor of Science (Technology). A
minimum of three years' concurrent industrial training in
approved industries is required before graduation.

Stage 5

5.622	Fluid Mechanics/ Thermodynamics	4	4
6.851R	Electronics and Instrumentation	3	0
6.852R	Electrical Machinery and Supply	0	3
7.313R	Mineral Processing	5	5
10.331	Statistics SS	2	2
		14	14

Stage 1

		Hours per week	
		S1	S2
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001	Mathematics I	6	6
		12	12

Stage 6

7.153R	Power Supply in Mines	2½	0
7.224R	Operational Management	1½	1½
7.314R	Mineral Process Technology	3	3
7.414R	Mineral Industry Project	4	6
	Two General Studies Electives	3	3
		14	13½

School of Textile Technology

Head of School

Professor M. Chaikin

Senior Administrative Officer (Faculty)

Mr R. F. Starr

The conversion of textile raw materials into their finished products is simply a succession of, and an interaction between, a number of chemical, physical and engineering processes. Graduates with a good background in physics, chemistry or engineering, and with a broad training in the range of textile sciences and technologies, as provided in the courses in Textile Technology, will substantially meet the present and future technological requirements of the textile and allied industries. Since present day textile technology is based on engineering and the fundamental sciences, excellent opportunities also await university-trained scientists and technologists in research and development organizations. Such scientists and technologists will play a decisive part in bridging the gap which exists between fundamental research and its industrial application.

Students are given the opportunity of choosing from four courses, viz Textile Chemistry, Textile Physics, Textile Engineering and Textile Manufacture. The course in Textile Manufacture, which includes subjects in Commerce, is especially designed to meet the need for executives in industry who have been given a comprehensive technological training. Each course extends over four years. All students take a common first year, and they need not choose the option they desire to follow until the end of that year. The aim of all four courses is to produce graduates who have acquired a comprehensive knowledge of all the textile sciences and technologies, the courses themselves differing only in the subjects offered outside the School in the second and third years. Students are normally required to undertake twelve weeks' industrial training during the long recesses between Years 2 and 3, and 3 and 4.

3170 Textile Technology — Full-time Course

Bachelor of Science
BSc

Year 1 (All courses)

	Hours per week
1.001 Physics I† or	
1.011 Higher Physics I	6
2.121 Chemistry IA and	
2.131 Chemistry IB	6
5.010 Engineering A and	
5.030 Engineering C*	6

10.001	Mathematics I or	
10.011	Higher Mathematics I	6

Hpw

6

24

*Including 13.001 Introduction to Textile Technology.

†Students who do not qualify for entry into 1.001 Physics I, may be allowed, at the discretion of the Head of the School, to substitute 1.021 Introductory Physics I. Such students will be ineligible to proceed to the Textile Physics course.

Textile Chemistry

Year 2

	Hpw
2.002A Physical Chemistry	
2.002B Organic Chemistry	9
2.002D Analytical Chemistry	
10.031 Mathematics	2
10.301 Statistics SA	2
13.111 Textile Technology I	8
13.211 Textile Science I	3
General Studies Elective	1½
	25½

Year 3

2.003B Organic Chemistry		
2.003H Molecular Spectroscopy and Structure	6	
13.112 Textile Technology II	12	
13.212 Textile Science II	2	
13.311 Textile Engineering I	1	
Two General Studies Electives	3	
	24	

Textile Physics

Year 2

	S1	S2
1.012 Mechanics and Thermal Physics	5	0
1.022 Electromagnetism and Modern Physics	0	5
1.032 Laboratory	3	3
10.1113 Multivariable Calculus and	2½	0
10.1114 Complex Analysis or	0	2½
10.1213 Multivariable Calculus and	2½	0
10.1214 Complex Analysis	0	2½
10.2111 Vector Calculus and	2½	0
10.2112 Mathematical Methods for Differential Equations or	0	2½
10.2211 Vector Analysis and	2½	0
10.2212 Mathematical Methods for Differential Equations	0	2½

		Hours per week	
		S1	S2
10.301	Statistics SA	2	2
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
	General Studies Elective	1½	1½
		27½	27½

Year 3

1.013	Quantum Mechanics and Nuclear Physics	2	2
1.023	Statistical Mechanics and Solid State Physics	4	0
1.033	Electromagnetism and Optical Physics	0	4
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	Two General Studies Electives	3	3
		24	24

Textile Engineering

Year 2

5.330	Engineering Dynamics	2	2
7.132	Fluid Mechanics and Machines	2	2
8.112	Materials and Structures	3	0
10.022	Engineering Mathematics II	4	4
10.301	Statistics SA	2	2
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
	General Studies Elective	1½	1½
		25½	22½

Year 3

5.111	Mechanical Engineering Design	4	4
5.331	Dynamics of Machines I	2	2
6.851	Electronics and Instrumentation	3	0
6.855	Electrical Power Utilization	0	3
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	Two General Studies Electives	3	3
		27	27

Textile Manufacture

Year 2

		Hours per week	
		S1	S2
10.301	Statistics SA	2	2
13.111	Textile Technology I	6	10
13.211	Textile Science I	3	3
14.501	Accounting and Financial Management IA	4	0
14.511	Accounting and Financial Management IB	0	4
15.001	Economics IA	4	0
15.011	Economics IB	0	4
15.501	Introduction to Industrial Relations	3	0
	General Studies Elective	1½	1½
		23½	24½

Year 3

		Hpw	
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
14.613	Business Finance II	3	0
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
	Two General Studies Electives*	3	3
		25	22

*Not to include Economics.

Year 4 (All courses)

13.113	Textile Technology III	6½
13.213	Textile Science III	4
13.312	Textile Engineering II	1½
13.411	Project	7
	Optional*	2
	General Studies Elective	1½
		22½

*Optional Subjects

13.223	Advanced Textile Chemistry
13.233	Advanced Textile Physics
13.313	Advanced Textile Engineering
14.602	Information Systems

School of Wool and Pastoral Sciences

Head of School

Associate Professor J. P. Kennedy

Administrative Officer

Mr J. E. Lawrence

Wool and Pastoral Sciences is concerned with the productivity of the pastoral industries and the quality and marketing of the products of these industries. The School of Wool and Pastoral Sciences offers a full-time course of four year's duration leading to the award of a Bachelor of Science.

The aims of the course are to provide opportunities for students to prepare themselves for careers in research, extension, education, marketing, management and administration in those institutions, corporations, government departments, firms and farms which are involved with pastoral production in Australia and overseas.

The course consists of education in the theory and application of scientific, economic and business management principles which are relevant in the production and utilization of pastures; the reproduction, nutrition, health, genetic improvement, ecology and management of sheep and cattle; the production, preparation for sale, measurement, specification and marketing of wool and meat animals; communication with the scientific, producer and marketing communities which are involved with the pastoral industries; and, the design and interpretation of experimental investigations.

There are similarities with courses in Agriculture and Rural Science, however special features of Wool and Pastoral Sciences are the education in Wool Science and the concentration on Australia's largest animal industries (sheep and cattle). Graduates of the course are eligible for corporate membership of the Australian Institute of Agricultural Science.

At the graduate level the School offers a course requiring one year of full-time or two years of part-time study leading to the award of the Graduate Diploma in Wool and Pastoral Sciences. Research may also be undertaken for the award of the degrees of Master of Science and Doctor of Philosophy.

Industrial Training Requirements

1. Students are required to obtain twenty-four weeks' practical experience on commercial properties. At least twenty weeks of experience must be obtained concurrently with the course, while up to four weeks may be allowed for practical experience obtained immediately prior to the commencement of the course.

2. Students are encouraged to obtain experience in a diversity of pastoral enterprises, ie cattle, sheep and cropping, in different climatic zones.

3. A maximum of eight weeks shall be allowed for practical experience on any one property, including home properties. Up to eight weeks employment at research or teaching institutions is allowed towards the industrial training requirement.

4. In order to obtain recognition for practical work carried out, students shall, within six weeks of the commencement of the Session immediately following the period of employment:

(1) Submit written evidence from the owner/manager of the property or the director of the institution as to the length of employment.

(2) Submit a written report along the guidelines which are available from the School.

3220

Wool and Pastoral Sciences — Full-time Course

Bachelor of Science BSc

Year 1

	Hours per week	
	S1	S2
2.111 Introductory Chemistry or	6	0
2.121 Chemistry IA	6	0
2.131 Chemistry IB	0	6
9.101 Biology of Grazing Sheep and Cattle	6	0
10.001 Mathematics I or		
10.011 Higher Mathematics I or	6	6
10.021B General Mathematics IB and	6	0
10.021C General Mathematics IC	0	6
17.021 Biology of Higher Organisms	0	6
27.111 Applied Physical Geography I*	6	6
	24	24

*Students may with the approval of the Head of the School substitute 1.011 Higher Physics I or 1.001 Physics I or 1.021 Introductory Physics for 27.111 Applied Physical Geography I.

Year 2

2.003J Agricultural and Biological Chemistry	4	4
9.111 Livestock Production I*	3	3
9.201 Agronomy	4	4
9.501 Wool Science I	7	7
9.601 Animal Physiology I	0	6
45.101 Biometry	6	0
General Studies Elective	1½	1½
	25½	25½

*A 4 day field excursion is an essential part of the subject.

Year 3

		Hpw	
		S1	S2
9.131	Animal Health I	0	3
9.202	Pastoral Agronomy	3	3
9.301	Agricultural Economics and Management I	2	4
9.421	Animal Nutrition	0	4
9.801	Genetics I	2	3
41.101	Biochemistry	12	0
	Two General Studies Electives	3	3
		22	20

		Hpw	
		S1	S2
9.412	Agricultural Chemistry II	6	6
9.502	Wool Science II	3	3
9.602	Animal Physiology II	4	4
9.901	Rural Extension	4	4
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
41.111	Biochemical Control	0	6
43.121	Plant Physiology	0	6
43.142	Environmental Botany	6	0
44.101	Introductory Microbiology*	6	0

†Range Management and Crop Agronomy are offered in alternate years.

*Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Plus at least one subject chosen from the list of optional subjects in each session. The choice is to be approved by the Head of School

Year 4

9.001	Project	6	6
9.002	Seminar	1	1
	General Studies Elective	1½	1½

Plus subjects providing at least 15 hours per week of lectures, tutorials and laboratory classes per session, chosen from the list of optional subjects. A minimum of 2 subjects in each session must be chosen from subjects in Group A. The choice of subjects is to be approved by the Head of School who may vary the requirements in special circumstances.

Optional subjects

Group A

		Hpw	
		S1	S2
9.113	Livestock Production III	3	3
9.132	Animal Health II	3	0
9.204	Range Management*†	0	3
9.503	Wool Science III	4	4
9.802	Genetics II	4	4
9.811	Biostatistics I	4	0
9.812	Biostatistics II	0	4

*One week of instruction at Fowlers Gap Research Station is an essential part of this course.

Group B

		Hpw	
		S1	S2
9.112	Livestock Production II	3	0
9.203	Crop Agronomy†	0	3
9.302	Agricultural Economics and Management II	3	3

Graduate Study

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1982* available from School Offices and the Admissions Office. This booklet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Graduate Study

The Faculty provides facilities for students to proceed to the award of the higher degrees of Doctor of Philosophy, Master of Engineering, Master of Science, Master of Applied Science, and Master of Environmental Studies. 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

award of a 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.

The Faculty offers a course leading to the award of the degree of Master of Environmental Studies. This is an interdisciplinary course designed to study the nature of environmental problems and the evaluation methodology. Students are usually in attendance at the University for one year on a full-time basis or for two years part-time.

Courses are also offered at the graduate level leading to the award of a Graduate Diploma. Students are required to attend courses of study for one year full-time or two years part-time. The courses available for the Graduate Diploma are Arid Lands Management, Corrosion Technology, Food Technology, Mining and Mineral Engineering and Wool Technology.

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

The conditions governing the award of the various higher degrees and graduate diplomas are set out later in this handbook in **Conditions for the Award of Higher Degrees**.

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.

relationship reflected in overlapping core programs. Terrain management also embraces geopollution management, with reference to groundwater and hydrological processes. Terrain evaluation is envisaged as serving a wide range of land management, including agricultural and biological management.

Soil Conservation

These programs are designed to provide graduate training in soil conservation for land management in arid zones. They are appropriate for personnel engaged in or preparing for positions in conservation or reclamation projects, agricultural advisory services, land-use planning, administration of pastoral lands, or research into problems of arid land management.

Range Management

These programs are designed to provide graduate training in the assessment and management of rangelands, and are also relevant to animal production and soil conservation, national parks and wildlife management, and land evaluation. They are appropriate for personnel engaged in or preparing for positions in project management, pastoral advisory services, and rangeland research or administration.

Management of Pastoral Enterprises

These programs are designed to provide graduate training in the production and management of grazing sheep and beef cattle, the production of pasture, range management, and in the economic management of pastoral enterprises.

Faculty of Applied Science

Graduate Programs in Arid Lands Management

General

The University has considerable experience of research and teaching relating to the management of arid environments, gained over many years by several of its Schools. This experience is being mobilized in the provision of graduate programs based at the University campus in Kensington, Sydney, but includes significant field studies using the resources at Fowlers Gap Arid Zone Research Station western New South Wales.

The programs include the following areas of study:

- Hydrogeology
- Land Evaluation
- Terrain Management
- Soil Conservation
- Range Management
- Management of Pastoral Enterprises

For most of the above study areas, programs are available leading to the award of the following graduate degrees:

8025	Master of Applied Science in Arid Land Management by Coursework
5025	Graduate Diploma in Arid Lands Management

Hydrogeology

These programs involve training in groundwater investigations, including geophysical investigations, and the assessment, development and utilization of groundwater resources. They are suited to geologists, engineers, agricultural scientists, planners and resource managers.

Land Evaluation and Terrain Management

These programs are designed to provide graduate training in the evaluation of land management and in the prediction of the environmental impact of land use. They include the two sectors of land evaluation and terrain management, with a close

8025

Arid Lands Management Graduate Course

Master of Applied Science MAppSc

Hydrogeology

Prerequisite: Four-year degree of appropriate standard in geology or in a relevant science.

Compulsory Subject

25.915G	Project in Hydrogeology or
25.916G	Research Project in Hydrogeology

Recommended Core Subjects

8.842G	Groundwater Hydrology
8.860G	Investigation of Groundwater Resources I
8.861G	Investigation of Groundwater Resources II
25.325	Engineering and Environmental Geology
25.411G	Arid Zone Engineering Geology*
25.413	Engineering and Environmental Resources

Candidates must also include additional subjects selected from core subjects in other programs in Water Resources, or from the listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and the Heads of the other

Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.701G	Economic Decision Making in Civil Engineering
8.703G	Optimization Techniques in Civil Engineering
8.833G	Free Surface Flow
8.839G	Advanced Flood Estimation
8.843G	Groundwater Hydraulics
8.847G	Water Resources Policy
8.848G	Water Resources System Design
8.849G	Irrigation
8.850G	Drainage of Agricultural Land
27.043G	Remote Sensing Applications
27.901G	Geomorphology for Hydrologists
27.914G	Terrain Evaluation
27.910G	Geomorphology of Arid Lands
27.911G	Soil Erosion and Conservation
27.913G	Soil Studies for Arid Lands Management
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Land Evaluation

Prerequisite: Four-year degree of appropriate standard in physical geography or geology, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

27.910G	Geomorphology of Arid Lands
27.913G	Soil Studies for Arid lands Management
27.914G	Terrain Evaluation
27.915G	Project in Land Evaluation or
27.916G	Research Project in Land Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

9.205G	Range Management‡
25.411G	Arid Zone Engineering Geology*
27.043G	Remote Sensing Applications
27.912G	Arid Zone Climatology
27.911G	Soil Erosion and Conservation
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems
45.900G	Ecological Studies in Arid Lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Terrain Management

Prerequisite: Four-year degree of appropriate standard in geology or physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

25.402G	Hydrogeology
25.407G	Geopollution Management
25.411G	Arid Zone Engineering Geology*
25.412G	Project in Terrain Management or
25.413G	Research Project in Terrain Management
27.910G	Geomorphology of Arid Lands
27.914G	Terrain Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.837G	Hydrological Processes
27.043G	Remote Sensing Applications
27.911G	Soil Erosion and Conservation
27.913G	Soils Studies for Arid Lands Management
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Soil Conservation

Prerequisite: Four-year degree of appropriate standard in physical geography or agricultural science, or in a relevant earth science or biological science.

Compulsory Subjects†

27.910G	Geomorphology of Arid Lands
27.911G	Soil Erosion and Conservation
27.913G	Soil Studies for Arid Lands Management
27.917G	Project in Soil Conservation or
27.918G	Research Project in Soil Conservation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.864G	Arid Zone Surface Water Hydrology§
8.865G	Arid Zone Water Resources Management
9.205G	Range Management‡
25.411G	Arid Zone Engineering Geology*
27.043G	Remote Sensing Applications
27.912G	Arid Zone Climatology

27.914G	Terrain Evaluation
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems
45.900G	Ecological Studies in Arid Lands Management

§Co-requisites 8.837G Hydrological Processes
8.838G Flood Design

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

5025 Arid Lands Management Graduate Diploma Course Graduate Diploma GradDip

Hydrogeology

Prerequisite: Degree in engineering or geology or in a relevant science.

Recommended Core Subjects

As for 8025 MAppSc Hydrogeology strand (see earlier this section).

Candidates must also include additional subjects selected from core subjects in other programs in Water Resources, or from the listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

As for 8025 MAppSc Hydrogeology strand (see earlier this section).

Land Evaluation

Prerequisite: Degree in physical geography or geology, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

27.910G	Geomorphology of Arid Lands
27.913G	Soil Studies for Arid Lands Management
27.914G	Terrain Evaluation
27.915G	Project in Land Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other

Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.205G	Range Management‡
25.411G	Arid Zone Engineering Geology*
27.043G	Remote Sensing Applications
27.911G	Soil Erosion and Conservation
27.912G	Arid Zone Climatology
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems
45.900G	Ecological Studies in Arid Lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Terrain Management

Prerequisite: Degree in geology or physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

25.411G	Arid Zone Engineering Geology*
25.412G	Project in Terrain Management
27.901G	Geomorphology of Arid Lands
27.914G	Terrain Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

8.837G	Hydrological Processes
25.402G	Hydrogeology
25.407G	Geopollution Management
27.043G	Remote Sensing Applications
27.911G	Soil Erosion and Conservation
27.913G	Soil Studies for Arid Lands Management
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Soil Conservation

Prerequisite: Degree in physical geography or agricultural science, or in a relevant earth science or biological science.

Compulsory Science†

27.910G	Geomorphology of Arid Lands
27.911G	Soil Erosion and Conservation
27.913G	Soil Studies for Arid Lands Management
27.917G	Project in Soil Conservation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

8.865G	Arid Zone Water Resources Management
9.205G	Range Management‡
25.411G	Arid Zone Engineering Geology*
27.043G	Remote Sensing Applications
27.912G	Arid Zone Climatology
27.914G	Terrain Evaluation
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information System
45.900G	Ecological Studies in Arid lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Range Management

Prerequisite: Degree in agricultural science, or in a relevant biological or earth science.

Compulsory Subject

9.205G	Range Management‡
--------	-------------------

Recommended Subject**

45.900G	Ecological Studies in Arid Lands Management
---------	---

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Wool and Pastoral Sciences and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.105G	Livestock Production
9.113	Livestock Production II
9.202	Pastoral Agronomy
9.421	Animal Nutrition
27.043G	Remote Sensing Applications
27.910G	Geomorphology for Arid Lands
27.911G	Soil Erosion and Conservation
27.912G	Arid Zone Climatology
27.913G	Soil Studies for Arid Lands Management
27.914G	Terrain Evaluation
29.601G	Remote Sensing Principles and Procedures
29.604G	Land Information Systems
43.121	Plant Physiology
43.142	Ecology and Environmental Botany
45.122	Animal Behaviour

**This subject may be omitted with permission of the Head of the School of Wool and Pastoral Sciences.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

Management of Pastoral Enterprises

Prerequisite: Degree in veterinary or agricultural science, or in a relevant biological science.

Recommended Subjects

9.105G	Livestock Production
9.205G	Range Management‡

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Wool and Pastoral Sciences and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.001	Project in Management of Pastoral Enterprises
9.113	Livestock Production III
9.131	Animal Health I
9.132	Animal Health II
9.202	Pastoral Agronomy
9.301	Agricultural Economics and Management I
9.302	Agricultural Economics and Management II
9.421	Animal Nutrition
9.503	Wool Science III
9.504G	Wool Science
9.602	Physiology II
9.802	Genetics II
9.803G	Animal Breeding
9.811	Biostatistics I
9.812	Biostatistics II
9.813G	Quantitative Methods
9.901	Rural Extension
45.122	Animal Behaviour
45.900G	Ecological Studies in Arid Lands Management

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

8026

Remote Sensing Graduate Course

Master of Applied Science MAppSc

The masters degree program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty will depend on the background of the applicant and the orientation of the proposed program.

Entry qualifications Four-year degree of appropriate standard in engineering, physical geography, geology, surveying, or in a relevant environmental biological or agricultural science.

Course requirements Candidates are required to complete a course totalling at least 36 credits, made up of compulsory subjects, elective subjects and a project or research project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the

appropriate Head of School. The degree will normally comprise one year of full-time study (two sessions of 18 credits) or two years of part-time study (four sessions of 9 credits each).

Candidates who are not exempted from any of the compulsory subjects and who opt for the Research Project (18 credits), will achieve the required 36 credits without any elective subjects.

Compulsory subjects

6.380G	Data Acquisition and Analysis in Remote Sensing	C3
6.387G	Programming and Software in Remote Sensing	C3
27.043G	Remote Sensing Applications	C3
29.601G	Remote Sensing Principles and Procedures*	C6
29.605G	Ground Investigations for Remote Sensing	C3

*Includes Group Practical Exercise in Remote Sensing, C3.

Project

Project in Remote Sensing or	C9
Research Project in Remote Sensing	C18

Elective subjects

Candidates are required to include additional subjects selected from the following listed elective subjects, or from other relevant subjects offered within the University, as approved by the appropriate Head of School, to complete a program totalling 36 credits.

6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	C3
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	C3
6.468G	Computer Display Systems and Interactive Instrumentation	C3
6.611	Computing I	C4
6.621	Computing II	C3
25.816G	Remote Sensing	C2
27.642	Mathematical Methods for Spatial Analysis	C2
27.643G	Geographic Data Analysis	C2
27.672G	Geographic Information Systems	C2
27.911G	Soil Erosion and Conservation	C6
29.520G	Photogrammetric Production Processes	C3
29.604G	Land Information Systems	C3

8045

Master of Environmental Studies MEnvStudies

This is an interdisciplinary course designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis, management and planning.

The subject matter covers a set of themes: resource use and conservation, pollution abatement, hazard perception and adjustment. Strong attention will be given to environmental impact assessment and conflict resolution.

The course is designed around three broad components for a minimum of 40 credits (1 credit = 1 hour per week per one session):

- Core subjects (10 credits)
- Project (20 credits)
- Electives (10 credits)

The core subjects and electives will consist of subjects specially designed together with appropriate subjects taken from those offered by a number of Faculties and Boards of Studies within the University of New South Wales. Prerequisites shall be determined by the relevant Subject Authority.

Core Subjects

27.202G	Environmental Planning and Evaluation	C3
36.945G	The Organization of Town Planning	C2
46.201G	Themes in Environmental Studies	C3
46.203G	Medical Aspects of Environmental Studies	C1
46.204G	Legal Aspects of Environmental Studies	C1

Project

46.200G	Project	C20
---------	---------	-----

Elective Subjects

Earth Science — Engineering

8.021	Environmental Aspects of Civil Engineering	C3
8.847G	Water Resources Policy	C3
25.404G	Environmental Geology	C3
25.407G	Geopollution Management	C3
25.410G	Coastal Environmental Geology	C3
27.173	Remote Sensing Applications	C3
27.234	Applied Geomorphology and Pedology	C8
27.902G	Meteorological and Hydrological Principles	C3

Chemistry — Biology

2.043A	Environmental Chemistry	C6
2.251G	Toxicology, Occupational and Public Health	C6
9.424G	Minerals and Their Effects on Grazing Animals	C2
27.344	Applied Biogeography and Bioclimatology	C8
42.212G	Principles of Biochemistry	C3
43.142	Ecology and Environmental Botany	C6
48.381G	Atmospheric Pollution Control	C4
48.386G	Unit Operations in Waste Management	C3

Social-Economic-Planning

8.402G	Transport, Environment, Community	C6
8.403G	Theory of Land Use/Transport Interaction	C3
30.935G	Organization Behaviour A	C3
37.3015	Environmental Impact Assessment I	C2
37.3016	Environmental Impact Assessment II	C2
37.3347	Landscape Conservation and Rehabilitation	C2
37.7116	Landscape Planning	C3
37.7195	Recreation Management and Design	C2
39.908G	Community Noise Control	C2
85.716G	Public Policy	C3

School of Applied Geology

8020

Engineering Geology-Hydrogeology- Environmental Geology Course

**Master of Applied Science
MAppSc**

The course consists of a Project (Group A) and six subjects chosen from Group B, at least one of which must be 25.402G Hydrogeology, 25.404G Environmental Geology, or 25.408G Engineering Geology. In special cases, eg where students have achieved a satisfactory standard in Geomechanics, those students taking 25.408G Engineering Geology and/or 25.409G Foundation Geology, may select in place of 25.406G either another subject from Group B, or one subject from another Faculty, provided such a subject is relevant to the course.

The Project normally consists of field and laboratory work, and is related to the student's major interest. Students must consult the Professor of Engineering Geology for approval of the Project.

		Hours per week	
		S1	S2
Group A			
25.403G	Project (Engineering Geology Graduate Course)	0	18
Group B			
25.402G	Hydrogeology	3	0
25.404G	Environmental Geology	3	0
25.405G	Engineering Geophysics	3	0
25.406G	Geological Basis of Geomechanics	3	0
25.407G	Geopollution Management	3	0
25.408G	Engineering Geology	3	0
25.409G	Foundation Geology	3	0
25.410G	Coastal Environmental Geology	3	0
27.904G	Geomorphology for Engineering Geologists	3	0

8091

Mineral Exploration Graduate Course

**Master of Applied Science
MAppSc**

The course is designed to give broad training in techniques of modern mineral exploration to geologists and mining engineers. Practical aspects are emphasized and the field-laboratory project is oriented to current problems of mineral exploration.

The duration of the course is one academic year of full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete Units A, B and C. Formal course work (Units A and B) accounts for 20-22 hours per week during Session 1. Some students (depending on their qualifications) may be required to take a Special Project, 25.000G, either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G	Seminar
25.801G	Geology in Exploration I
25.802G	General Introduction to Exploration Geophysics
25.803G	Introduction to Exploration Geochemistry
25.804G	Introduction to Data Processing and Interpretation
25.805G	Resource Economics I
25.807G	Exploration Geophysics
25.808G	Exploration Project
7.013*	Principles of Mining
7.044*	Mining Economics

Seven days of field tutorials are an integral part of Unit A.

*These are one session subjects, ie weeks 1-14.

Unit B (Weeks 8-14 Session 1)

25.811G	Advanced Geology in Exploration
25.815G	Resource Economics II
25.816G	Remote Sensing
25.817G	Mining Law and Exploration Management
25.840G	Seminar
7.001G	Exploration Drilling
7.013*	Principle of Mining
7.044*	Mining Economics
25.818G	Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session 2)

25.819G	Field — Laboratory Project
---------	----------------------------

8092

Exploration Geophysics Graduate Course

**Master of Applied Science
MAppSc**

This is a specialized course in the techniques of exploration geophysics relevant to the current needs of the exploration

industry. Practical applications are emphasized, and the field-laboratory project is designed to investigate aspects of specific exploration problems.

The duration of the course is one academic year full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete Units A, B and C. Formal course work (Units A and B) accounts for 20-22 hours per week during Session 1. Some students (depending upon their qualifications) may be required to take a Special Project 25.000G either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G	Seminar
25.801G	Geology in Exploration I
25.802G	General Introduction to Exploration Geophysics
25.803G	Introduction to Exploration Geochemistry
25.804G	Introduction to Data Processing and Interpretation
25.805G	Resource Economics I
25.807G	Exploration Geophysics

Seven days field tutorials are an integral part of Unit A.

Unit B (Weeks 8-14 Session 1)

25.831G	Geological Interpretation
25.832G	Advanced Exploration Geophysics
25.840G	Seminar

Unit C (Session 2)

25.839G	Field — Laboratory Project
---------	----------------------------

8093 Exploration Geochemistry Graduate Course Master of Applied Science MAppSc

This is a specialist course in the techniques of exploration geochemistry covering general principles, specific field appli-

cations, laboratory techniques, and data display and interpretation. Practical applications are emphasized and the field-laboratory project is designed to investigate aspects of mineral exploration problems.

The duration of the course is one academic year of full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete units A, B and C. Formal course work (Units A and B) accounts for 20-22 hours per week during Session 1. Some students (depending upon their qualifications) may be required to take a Special Project, 25.000G, either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G	Seminar
25.801G	Geology in Exploration I
25.802G	General Introduction to Exploration Geophysics
25.803G	Introduction to Exploration Geochemistry
25.804G	Introduction to Data Processing and Interpretation
25.805G	Resource Economics I
and either	
7.013*	Principles of Mining
and	
7.044*	Mining Economics
or	
25.808	Exploration Project

Seven days field tutorials are an integral part of Unit A.

*These are one session subjects, ie weeks 1-14.

Unit B (Weeks 8-14 Session 1)

25.821G	Geology in Exploration II
25.823G	Advanced Exploration Geochemistry
25.824G	Advanced Data Processing and Interpretation
25.827G	Laboratory methods
25.840G	Seminar
and either	
7.013*	Principles of Mining
and	
7.044*	Mining Economics
or	
25.828G	Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session C)

25.829G	Field — Laboratory Project
---------	----------------------------

School of Chemical Engineering and Industrial Chemistry

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

Master of Applied Science Degree Courses*

The MAppSc courses involve a project which must integrate and apply the principles treated in the course. It may take the form of a design feasibility study or an experimental investigation. Evidence of initiative and of a high level of ability and understanding is required in the student's approach, and the results must be embodied in a report and submitted in accordance with the University's requirements.

The following graduate courses are available to Master of Applied Science degree candidates. Candidates may specialize in the following areas:

8000 Bioprocess Engineering
8005 Chemical Technology
8010 Chemical Engineering
8040 Environmental Pollution Control**
8060 Fuel Technology
and
8080 Industrial Pollution Control

The MAppSc degree courses provide for a comprehensive study of theoretical and practical aspects of many advanced topics. The courses are formal and elective in nature and provide an opportunity for graduates to apply their basic skills in fields in which the School has developed special expertise.

The courses specializing in Chemical Engineering, Chemical Technology, Industrial Pollution Control and Fuel Technology are primarily intended for graduates in Applied Science, Engineering, or Science with principal interests in Chemistry, Mathematics and/or Physics. The course specializing in Bioprocess Engineering is primarily intended for graduates in Agriculture, Applied Science, and Science with principal interests in Biochemistry, Chemistry and/or Microbiology. They are designed to allow the maximum flexibility consistent with the standing of the award.

Intending candidates are invited to submit proposed study programs to the Head of the School for advice and recommendation. Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science. An acceptable course would be a program of formal study aggregating approximately 20 hours weekly for two sessions full-time or ten hours weekly for four sessions part-time, and which could comprise:

*All courses are subject to a review in 1982 and some may be discontinued.

**This course will be discontinued after 1982 and no new enrolments accepted.

1. A major strand of course material making up 75% of the total program. This includes a project constituting not less than 15% and not more than 30% of the program;

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

3. Undergraduate material (generally designated as subjects without a suffixed G number), which may be included in one or both strands but may not exceed 25% of the total program.

Approximately 60% of the program (including the project) must be undertaken in the School of Chemical Engineering. The remainder, subject to approval and availability, may be undertaken in other Schools within the University. Full details of all subjects are listed under **Disciplines of the University** in the Calendar.

8000 Bioprocess Engineering Graduate Courses* Master of Applied Science MAppSc

The graduate subjects offered have been unitized to provide maximum flexibility. Any combination of units may be selected, subject to prerequisites or co-requisites as specified. Further, some of these units are designed as bridging material and would not be offered to graduates with previous qualifications in these particular areas.

The units offered are summarized below.

		Hours per week	
		S1	S2
48.281G	Design of Microbial Reactors		
	Unit 1 Rate Processes	1	0
	Unit 2 Fundamentals of Microbial Stoichiometry	1	0
	Unit 3 Design of Microbial Reactors	0	2
48.282G	Microbial Kinetics and Energetics		
	Unit 1 Microbial Kinetics	1	1
	Unit 2 Microbial Energetics	2	2
48.283G	Bioprocess Unit Operations and Equipment Design	3	2
48.284G	Heat, Mass and Momentum Transport	1	1
48.285G	Bioprocess Laboratory	3	or 3

This course is designed to provide professional training in the application of chemical engineering principles in the bioprocess industries. It extends over one full-time year or two part-time years and leads to the award of the degree of Master of Applied Science as outlined above.

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

As the material in this course will be of interest to graduates from a wide range of disciplines, the suggested course outlines consist of a central core selected from the subjects above and a range of background material. This background material can be designed to suit graduates from either of the two groups consisting of firstly Applied Science, Engineering or Science with principal interests in Chemistry, Mathematics, or Physics, or, secondly, Agriculture or Science graduates with principal interests in Biochemistry, Chemistry and/or Microbiology. Graduates with an inadequate background in Mathematics and/or rate processes will be required to do a bridging course consisting of a specified reading list with associated assignments up to a maximum of 1 hour per week.

Suggested course outlines for graduates from the two primary areas are given below, however these outlines may be modified to suit individual interests within the general requirements for the MAppSc degree course described above.

Applied Science Graduate or equivalent

Core Material

	Hours per week
48.281G Unit 3 Design of Microbial Reactors	1
48.282G Microbial Kinetics and Energetics	3
48.283G Bioprocess Unit Operations and Equipment Design	2½
48.285G Bioprocess Laboratory	1½
48.900G Project	6

Plus 6 hours of other material, for example:

1. Students wishing a more complete coverage of the life sciences may select

42.211G Principles of Biology	1½
42.212G Principles of Biochemistry	1½
44.101 Introductory Microbiology*	6
	(S1 only)

*Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

2. Students wishing to reinforce other areas in chemical engineering may select

44.101 Introductory Microbiology*	6
	(S1 only)
48.281G Unit 2 — Fundamentals of Microbial Stoichiometry	½
plus other elective material	3

*Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Science Graduate with a principal interest in the Life Sciences or equivalent

Core Material

	Hours per week
48.281G Unit 1 Rate Processes	½
Unit 3 Design of Microbial Reactors	1
48.282G Microbial Kinetics and Energetics	3
48.283G Bioprocess Unit Operations and Equipment Design	2½
48.284G Heat, Mass and Momentum Transport	1
48.900G Project	6

Plus 6 hours of other material, for example:

48.063G Industrial Water and Wastewater Engineering	2
38.159G Food Process Wastes	½
48.396G Unit Operations in Waste Management	1½
Reading List (Mathematics)	1

8005

Chemical Technology Graduate Course*

Master of Applied Science MAppSc

The aim of this course is not to produce narrow specialists but to train graduates to identify and solve a wide range of problems in those areas of the chemical industry concerned with the production and development of inorganic chemicals, organic chemicals, surface coatings, plastics, elastomers, or ceramic materials. The method is student participation in formal courses and projects of a collaborative kind.

Graduate subjects in Industrial Chemistry may be selected from:

	Hours per week
48.110G Process Evaluation	3‡
48.120G Machine Computation in Chemical Technology	6
48.130G Chemical Reactor Analysis and Control	6
48.131G Catalysis and Applied Reaction Kinetics	6
48.140G Chemical Process Simulation	6
48.141G Modelling in Chemical Technology	6
48.142G Chemical Process Control	6

	Hpw
48.150G Instrumental Analysis for Industry	3‡
48.160G Industrial Electrochemistry	6
48.161G Electrochemical Techniques for Control and Analysis	6
48.400G Polymer Science	10
48.410G Analytical Characterization of Polymers	8
48.430G Polymer Engineering	6
48.440G Polymer Physics	6
48.900G Major Project	6‡
48.901G Minor Project	3‡

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

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

Depending on the candidate's background, enrolment in some of the above subjects may be accompanied by enrolment in related undergraduate subjects as prerequisites or co-requisites. A given subject may not necessarily be conducted in any one year.

8010 Chemical Engineering Graduate Course*

Master of Applied Science MAppSc

The graduate course in Chemical Engineering provides an opportunity, primarily for graduates in Chemical Engineering, to continue first degree formal studies into topics to a depth not found in an undergraduate course. It also provides an opportunity for graduates of some experience to periodically undertake advanced or refresher courses.

8040 Environmental Pollution Control Graduate Course*†

Master of Applied Science MAppSc

The graduate course in Environmental Pollution Control leads to the award of 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 who have completed a four year Bachelor degree program in Chemical Engineering or Industrial Chemistry, but candidates from other disciplines may be admitted.

The advent of new laws governing the disposal of effluents into the environment will make the problems of industry more acute as industrial processes are developed and expanded. This course is intended to cover the problems in environmental engineering which may be encountered in industrial plants.

*For additional information on the MAppSc degree course see earlier this section.

†This course will be discontinued after 1982 and no new enrolments accepted.

	Hours per week
1.	
48.070G Process Principles or Graduate Elective	2
2.	
27.902G Meteorological and Hydrological Principles	1
36.062G Urban Planning	1/2
44.101 Introductory Microbiology*	6
	(S1 only)
48.064G Medical Aspects	1/2
48.066G Legislative Aspects	1/2
3.	
38.159G Food Process Wastes	1/2
39.908G Community Noise Control	1
48.063G Industrial Water and Wastewater Engineering	2
48.381G Atmospheric Pollution and Control	2
48.386G Unit Operations in Waste Management	1 1/2
Optional Elective(s) and	3
48.901G Minor Project or	3
48.900G Project	6

*Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

48.070G Process Principles is a bridging subject for all candidates other than Chemical Engineering and Industrial Chemistry graduates. Candidates who have passed the equivalent of first year Chemistry take 48.070G Process Principles, and those who have passed the equivalent of second year Chemistry may take specified parts of 48.070G Process Principles and an approved graduate elective each for one hour per week. Graduates in Chemical Engineering or Industrial Chemistry take an approved elective.

All electives must be approved by the Head of the School but applications will be considered regarding any subject available in the University which has a relevance to Pollution Control.

Students intending to undertake the course over two part-time years may do so by attending on one afternoon and two evenings per week. Every effort should be made to include in the first part-time year the subjects listed in **1.** and **2.** above.

The work involved in 48.901G Minor Project must be embodied in a report and submitted in accordance with the requirements of the School.

8060 Fuel Technology Graduate Course*

Master of Applied Science MAppSc

A formal course leading to the award of the degree of Master of Applied Science. It is a two-year part-time course designed to provide professional training and specialization in fuel science or fuel engineering for graduates in science, applied

science or engineering who have not had substantial previous formal education in these subjects.

The course is based on the general formula for a MAppSc degree program, whereby the subjects 48.311 and 48.321 can comprise the 25% undergraduate component, the project (15 or 30% of the program) is 48.900G, and the remainder of the hours can be taken from the units offered in the 48.38-G series of subjects. There are also compulsory seminar and laboratory practice subjects.

The course allows reasonable flexibility with a choice of subjects, and units within subjects, subject to the availability of staff.

Provision is made for subjects outside those offered by the Department to be incorporated in the program at either graduate or undergraduate level.

8080 Industrial Pollution Control Graduate Course*

Master of Applied Science MAppSc

This course is intended for graduates who wish to undertake further studies in environmental topics of a more specialized nature than the class of subjects offered in course 8040. For this reason applicants will normally have undertaken a first degree in an area of application to industrial processes.

Candidates design their proposed programs of study on the basis of subjects available in the 8040 course in a chosen specialized field. Supplementary supporting subjects, as may be available, are taken subject to the general rules above for acceptable formal study programs. In the design of their course candidates are expected to have an objective of contributing to the relief of industrial pollution problems.

5010 Corrosion Technology Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma course in Corrosion Technology is open to graduates in Engineering, Applied Science or Science who

wish to undertake formal studies to promote their careers in industry. At present it may only be taken as a two year part-time course.

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

For graduates from Engineering (non-chemical) or Science (in a particular major) a bridging course is a necessary introduction to the graduate level of certain subjects. For this purpose the subject, 48.070G Process Principles, is specified.

The first year of the course introduces elementary aspects of corrosion technology and suitably orientates students depending on their initial qualifications. The second year of the course contains more detailed instruction at a graduate level in corrosion theory and prevention, together with suitable laboratory assignments.

Year 1

	Hours per week
48.070G Process Principles or	2
48.072G Corrosion Laboratory	2
48.071G Corrosion Technology I	3
	<hr/>
	5
	<hr/>

Chemical Engineering graduates will undertake:

48.072G Corrosion Laboratory

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

48.070G Process Principles (1 hr/wk)

48.072G Corrosion Laboratory (1 hr/wk)

Graduates who have passed only the equivalent of first year Chemistry will undertake 48.070G Process Principles.

Year 2

	Hpw
48.073G Corrosion Materials	2
48.074G Corrosion Technology II	3
48.075G Seminar	1
48.076G Corrosion Literature Review	2
48.077G Testing Laboratory (by roster)	2
	<hr/>
	10
	<hr/>

*For additional information on the MAppSc degree course see earlier in this section.

School of Food Technology

The School of Food Technology conducts formal courses leading to the award of the Master of Applied Science degree and of the Graduate Diploma in food technology.

In addition, the School welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in food science and technology for the award of the degrees of Master of Science and Doctor of Philosophy.

The Head of School provides information on research scholarships, fellowships, grants-in-aid and School research activities. Graduates are advised to consult the Head of School before making a formal application for registration.

8030 Food Technology Graduate Course

Master of Applied Science MAppSc

This course provides for a comprehensive study of theoretical and applied aspects of the science and technology of foods. The course is formal and elective in nature, providing an opportunity for graduates to apply their basic skills in areas relevant to this field of applied science. It is a course particularly relevant to graduates in Agriculture, Applied Science and Science with principal interests in Chemistry, Biochemistry, Microbiology, Physiology, Nutrition and Chemical Engineering.

Intending candidates are invited to submit proposed study programs to the Head of the School for advice and recommendation. Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science. An acceptable course would be a program of formal study aggregating approximately 20 hours weekly for two sessions full-time or ten hours weekly for four sessions part-time, and which could comprise:

1. A major strand of course material making up 75 per cent of the total program. This would include a project constituting not less than 15 per cent and not more than 30 per cent of the program.
2. A minor strand of broader-based supporting material making up to 25 per cent of the total program.

Undergraduate material may be included in one or both strands but may not exceed 25 per cent of the total program. Approximately 60 per cent of the program (including the project) must be taken in the School of Food Technology. The remainder, subject to approval and availability, may be undertaken in other schools within the University.

Graduate subjects in Food Technology may be selected from:

	Hours per week*
38.151G Introductory Food Science	1
38.152G Food Process Laboratory	3
38.153G Food Technology Seminar	1
38.154G Food Technology	6
38.155G Dairy Technology	2
38.156G Oenology	1
38.157G Technology of Cereal Products	1
38.158G Marine Products	1
38.160G Food Quality Assessment	1
38.161G Food Additives and Toxicology	1
38.162G Postharvest Physiology and Handling of Fruit and Vegetables	3
38.163G Methods in Food and Nutrition Education	1½
38.351G The Microbial Ecology of Foods	3
38.451G Advanced Food Engineering	1½
38.452G Drying of Foods	1½
38.551G Advanced Nutrition	1½
38.552G Methods in Nutritional Assessment and Analysis	1½
38.900G Major Project	6
38.901G Minor Project	3

The work involved in the project must be embodied in a report and submitted in accordance with the requirements of the Faculty.

Depending on the candidate's background, enrolment in some of the above subjects may be accompanied by enrolment in related undergraduate subjects as prerequisites or co-requisites. A particular subject may not necessarily be conducted in any one year.

5020 Food Technology Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma course is designed to provide professional training at an advanced level for graduates in Science, Applied Science or Engineering who have not had previous training in Food Technology.

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

Requirements are a first degree and, in some cases, the successful completion of assignments or examinations, as directed by the Head of the School.

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

	Hours per week*
38.151G Introductory Food Science	1
38.152G Food Process Laboratory	3
38.153G Food Technology Seminar	1
38.154G Food Technology	6
Electives†	7

†Electives are to be selected from the following list of subjects according to availability and with the approval of the Head of School.

	Hours per week*
2.271G Chemistry and Analysis of Foods	3
38.142 Oenology	3
38.144 Treatment and Utilization of Food Processing Wastes	1½
38.157G Technology of Cereal Products	1
38.158G Marine Products	1
38.162G Postharvest Physiology and Handling of Fruit and Vegetables	3
38.163G Methods in Food and Nutrition Education	1½
38.341 Food Microbiology II	3
38.344 Yeast Technology	1½
38.431 Food Engineering II	3
38.442 Food Engineering III	3
38.542 Special Topics in Nutrition	1½
38.551G Advanced Nutrition	1½
38.552G Methods of Nutritional Assessment and Analysis	1½
42.102A Biotechnology A	3
42.211G Principles of Biology	1½
42.212G Principles of Biochemistry	1½
42.213G Biochemical Methods	1½
42.214G Biotechnology	1½
44.143 Microbiology AS	5

or such other electives approved by the Head of School. In all cases the hours devoted to graduate subjects constitute at least 50 per cent of the total course hours.

School of Metallurgy

The School of Metallurgy conducts courses which lead to the award of Master of Applied Science.

In addition, the School welcomes enquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science, Master of Engineering or Doctor of Philosophy in metallurgy or ceramic engineering.

The Head of the School is 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.

8050 Metallurgy Graduate Course Master of Applied Science MAppSc

This course provides for a comprehensive study of theoretical and practical topics at an advanced level. It is designed to allow the maximum flexibility in choice of topics consistent with the standing of the award.

Intending candidates are invited to discuss proposed study programs with the Head of the School for advice and recommendation.

An acceptable program would be:

1. A program of formal study (including a project) totalling approximately twenty hours per week for two sessions full-time.
2. A project comprising about twenty per cent of the program.

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

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

Graduate Subjects

		Hours per week*
4.241G	Graduate Metallurgy Project	Not less than 4
4.211G	Metallurgical Practice	4 to 8
	Detailed studies relating to one or more of the following:	
	1. Extractive Metallurgy	
	2. Metal working and forming	
	3. Foundry practice	
	4. Welding and metal fabrication	
	5. Metal finishing and corrosion protection	
4.221G	Advanced Metallurgical Techniques	1 to 2
4.231G	Specialist lectures in Advanced Theoretical Metallurgy	Offered in units of 7 hours (ie 1 hour/week for 7 weeks)
4.251G	Advanced Materials Technology	3
4.270G	Solid State and Mineral Chemistry	2
4.271G	Refractory Technology I	6
4.272G	Refractory Technology II	6
4.281G	Chemistry of Glass Melting	6

*These may be presented at twice the weekly rate over one session.

Undergraduate Subjects

These subjects are intended for inclusion in qualifying courses and to satisfy prerequisites and co-requisites for students whose first degree is in a field other than metallurgy.

	Hours per week
4.121 Principles of Metal Extraction	3
4.131 Principles of Physical and Mechanical Metallurgy	3
4.141 Experimental Techniques in Physical Metallurgy	2

The above undergraduate subjects offered by the School of Metallurgy and undergraduate and graduate subjects offered by other Schools of the University may be included, but may not exceed 20 per cent of the total program.

School of Mining Engineering

8055

Minerals Engineering Graduate Course

Master of Applied Science MAppSc

The course is designed to provide a comprehensive study of theoretical and practical aspects of mineral processing technology at an advanced level. Formal subjects represent approximately 75 per cent of the program, the remaining 25 per cent being devoted to a project. Election in choice of project work permits specialization in mineral processing or coal preparation. Candidates who do not have an appropriate academic background may be required to enrol in related undergraduate subjects as prerequisites. Consideration is given to full-time or part-time enrolment.

Subjects

	Hours per week	
	S1	S2
7.013 Principles of Mining	2	0
7.361G Minerals Engineering I	7	0
7.362G Minerals Engineering II	8	0
7.363G Minerals Engineering Laboratory	3	0
7.364G Minerals Engineering III	0	8
7.365G Minerals Engineering Project	0	10
7.442G Minerals Industry Analysis	0	2
	20	20

1. When appropriate, and subject to the approval of the Head of the Department, up to 4 hours per week may be selected from approved courses offered within the University in place of units in which students have prior expertise.

2. Undergraduate material may not exceed 20 per cent of the total program.

3. The work involved in the project must be embodied in a report and submitted in accordance with the requirements of Faculty.

4. Attendance at field trips totalling up to one week may be required.

5040

Mining and Minerals Engineering Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma course in Mining and Minerals Engineering is designed to provide professional training for

graduates in Science, Applied Science or Engineering who wish to specialize in the fields of mining and mineral beneficiation. The course is concerned primarily with instruction in the scientific and engineering principles associated with the mining and beneficiation of minerals and coal.

The Graduate Diploma in Mining and Minerals Engineering (GradDip) will be awarded on the successful completion of one year full-time or two years part-time study. The course is a blend of lecture and laboratory work and allows the choice of elective specialization in either mining engineering or mineral processing and coal preparation.

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

When appropriate, certain sections of the course may be offered as a unit over a short period of time to permit mineral industry personnel to attend the advanced course in a particular area of that discipline.

Year 1 — Part-time

		Hours per week	
		S1	S2
7.013	Principles of Mining	2	0
7.023	Mineral Process Engineering	2	0
7.033	Mineralogical Assessment	1	0
7.234	Mineral Economics	1	1
7.311G	Mineral Beneficiation	0	3
7.111G	Mining Engineering	0	3
		6	7

Year 2 — Part-time

7.122G	Mining Engineering Technology		
	or	6	0
7.322G	Mineral Beneficiation		
	Technology	6	0
7.132G	Mining Engineering Laboratory		
	and Project or	0	6
7.332G	Mineral Engineering Laboratory	0	6
		6	6

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

School of Wool and Pastoral Sciences

5081

Wool and Pastoral Sciences Graduate Diploma Course

Graduate Diploma GradDip

The course leading to the award of the Graduate Diploma in Wool and Pastoral Sciences 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.

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. 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.

Applicants from Colleges of Advanced Education who have obtained credit passes or better in the Diploma of Applied Science (Agriculture) are eligible for consideration for direct entry into the Graduate Diploma course in Wool and Pastoral Sciences.

The following program may be completed either in one year on a full-time basis or over two years on a part-time basis. Students are required to carry out full-time study or its equivalent to the extent of eighteen hours lecture and laboratory work per week for two sessions. Both graduate subjects and undergraduate subjects may be chosen to suit the requirements of the student subject to their availability and the approval of the Head of the School.

Full-time Course

18 hours per week of which at least 10 must be chosen from:

	Hours per week
9.105G Livestock Production	6
9.205G Range Management	4
9.504G Wool Science	6
9.803G Animal Breeding	4
9.813G Quantitative Methods	4

A maximum of 8 hours per week of study may be selected from approved undergraduate subjects.

Graduate Diploma students are expected to work at the level of honours students in the undergraduate courses and to carry out prescribed study of current research material in the appropriate field.

Graduate Study

Conditions for the Award of Higher Degrees

Rules, regulations and conditions for the award of first degrees are set out in the appropriate Faculty Handbooks.

For the list of undergraduate courses and degrees offered see **Disciplines of the University: Faculty Table (Undergraduate Study)** in the Calendar.

The following is the list of higher degrees and graduate diplomas of the University, together with the publication in which the conditions for the award appear.

For the list of graduate degrees by research and course work, arranged in faculty order, see **Disciplines of the University: Table of Courses (by faculty): Graduate Study** in the Calendar.

For the statements **Preparations and Submissions of Project Reports and Theses for Higher Degrees** and **Policy with respect to the Use of Higher Degree Theses** see the Calendar.

First Degrees**Higher Degrees**

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine	MD	Calendar Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science

Higher Degrees

Title	Abbreviation	Calendar/Handbook
Master of Architectural Design	MArchDes	Architecture
Master of Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Arts	MA(Hons)	Arts
	MA	Military Studies
		Arts
		Military Studies
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture
Master of the Built Environment	MBEnv	Architecture
Master of the Built Environment (Building Conservation)		
Master of Business Administration	MBA	AGSM
Master of Chemistry	MChem	Sciences*
Master of Commerce (Honours)	MCom(Hons)	Commerce
Master of Commerce	MCom	Commerce
Master of Education	MEd	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science
Master of Engineering without supervision		Engineering
Master of Engineering Science	MEngSc	Engineering
		Military Studies
Master of Environmental Studies	MEnvStudies	Applied Science
Master of General Studies	MGenStud	General Studies
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPed	Calendar†
Master of Health Planning	MHP	Professional Studies
Master of Landscape Architecture	MLArch	Architecture
Master of Laws by Research	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Mathematics	MMath	Sciences*
Master of Optometry	MOptom	Sciences*
Master of Paediatrics	MPaed	Medicine
Master of Physics	MPhys	Sciences*
Master of Psychology	MPsychol	Sciences‡
Master of Public Administration	MPA	AGSM
Master of Science	MSc	Applied Science
Master of Science without supervision		Architecture
		Engineering
		Medicine
		Military Studies
		Sciences*‡
Master of Science (Acoustics)	MSc(Acoustics)	Architecture
Master of Science and Society	MScSoc	Sciences*
Master of Science (Biotechnology)	MSc(Biotech)	Sciences‡
Master of Science (Building)	MSc(Building)	Architecture
Master of Social Work	MSW	Professional Studies
Master of Statistics	MStats	Sciences*
Master of Surgery	MS	Medicine
Master of Surveying	MSurv	Engineering
Master of Surveying without supervision		

Title	Abbreviation	Calendar/Handbook
Master of Surveying Science	MSurvSc	Engineering
Master of Town Planning	MTP	Architecture
Graduate Diploma	GradDip	Applied Science Architecture Engineering Sciences† Sciences*
	DipFDA	Professional Studies
	DipEd	
	DipIM-ArchivAdmin	
	DipIM-Lib	

Graduate Diplomas

*Faculty of Science.

†Professorial Board.

‡Faculty of Biological Sciences.

1. The degree of Doctor of Philosophy may be granted by the Council on the recommendation of the Professorial Board to a candidate who has made an original and significant contribution to knowledge and who has satisfied the following requirements:

Doctor of Philosophy (PhD)

2. A candidate for registration for the degree of Doctor of Philosophy shall:

Qualifications

(1) hold an honours degree from the University of New South Wales; or

(2) hold an honours degree of equivalent standing from another approved university; or

(3) if the candidate holds a degree without honours from the University of New South Wales or other approved university, have achieved by subsequent work and study a standard recognized by the higher degree Committee of the appropriate faculty or board of studies (hereinafter referred to as the Committee) as equivalent to honours; or

(4) in exceptional cases, submit such other evidence of general and professional qualifications as may be approved by the Professorial Board on the recommendation of the Committee.

3. When the Committee is not satisfied with the qualifications submitted by a candidate, the Committee may require the candidate, before being permitted to register, to undergo such examination or carry out such work as the Committee may prescribe.

4. A candidate for registration for a course of study leading to the degree of Doctor of Philosophy shall apply to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

Registration

5. Subsequent to registration the candidate shall pursue a program of advanced study and research for at least six academic sessions, save that:

(1) a candidate fully engaged in advanced study and research for the degree, who before registration was engaged upon research to the satisfaction of the Committee, may be exempted from not more than two academic sessions;

(2) in special circumstances the Committee may grant permission for the candidate to spend not more than one calendar year of the program in advanced study and research at another institution provided that the work can be supervised in a manner satisfactory to the Committee;

(3) in exceptional cases, the Professorial Board on the recommendation of the Committee may grant permission for a candidate to be exempted from not more than two academic sessions.

6. A candidate who is fully engaged in research for the degree shall present for examination not later than ten academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the Committee.

7. The candidate shall be fully engaged in advanced study and research, save that:

(1) the Committee may permit a candidate to undertake a limited amount of University teaching or outside work which in its judgement will not interfere with the continuous pursuit of the proposed course of advanced study and research;

(2) a member of the full-time staff of the University may be accepted as a part-time candidate for the degree, in which case the Committee shall prescribe a minimum period for the duration of the program;

(3) in special circumstances, the Committee may, with the concurrence of the Professorial Board, accept as a part-time candidate for the degree a person who is not a member of the full-time staff of the University and is engaged in an occupation which, in its opinion, leaves the candidate substantially free to pursue a program in a school* of the University. In such a case the Committee shall prescribe for the duration of the program a minimum period which, in its opinion, having regard to the proportion of the time which the candidate is able to devote to the program in the appropriate University school* is equivalent to the six sessions ordinarily required.

8. Every candidate shall pursue a program under the direction of a supervisor appointed by the Committee from the full-time members of the University staff. The work, other than field work, shall be carried out in a school* of the University save that in special cases the Committee may permit a candidate to conduct the work at other places where special facilities not possessed by the University may be available. Such permission will be granted only if the direction of the work remains wholly under the control of the supervisor.

9. Not later than two academic sessions after registration the candidate shall submit the topic of research for approval by the Committee. After the topic has been approved it may not be changed except with the permission of the Committee.

10. A candidate may be required by the Committee to attend a formal course of appropriate study.

Thesis

11. On completing the course of study every candidate must submit a thesis which complies with the following requirements:

(1) the greater proportion of the work described must have been completed subsequent to registration for the PhD degree;

(2) it must be an original and significant contribution to the knowledge of the subject;

(3) it must be written in English except that a candidate in the Faculty of Arts may be required by the Faculty on the recommendation of the supervisor to write the thesis in an appropriate foreign language;

(4) it must reach a satisfactory standard of expression and presentation.

12. The thesis must present the candidate's own account of the research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied on the candidate's part in the joint research.

13. Every candidate shall be required to submit with the thesis a short abstract of the thesis comprising not more than 350 words.

The abstract shall indicate:

(1) the problem investigated;

(2) the procedures followed;

(3) the general results obtained;

(4) the major conclusions reached;

but shall not contain any illustrative matter, such as tables, graphs or charts.

*Or department where a department is not within a school.

14. A candidate may not submit as the main content of the thesis any work or material which has previously been submitted for a university degree or other similar award.

15. The candidate shall give in writing two months' notice of intention to submit the thesis.

Entry for Examination

16. Four copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may also submit any work previously published whether or not such work is related to the thesis.

17. It shall be understood that the University retains the four copies of the thesis submitted for examination, and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

18. There shall normally be three examiners of the thesis, appointed by the Professorial Board on the recommendation of the Committee, at least two of whom shall be external to the University.

19. At the conclusion of the examination each examiner shall submit to the Committee a concise report on the merits of the thesis and shall recommend to the Committee that:

- (1) The candidate be awarded the degree without further examination; or
- (2) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or
- (3) the candidate be awarded the degree subject to a further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or
- (4) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or
- (5) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

20. If the performance at the further examination recommended under Rule 19. (3) is not to the satisfaction of the Committee the Committee may permit the candidate to re-present the same thesis and submit to a further oral, practical or written examination within a period specified by them but not exceeding eighteen months.

21. The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be admitted to the degree.

22. A candidate shall be required to pay such fees as may be determined from time to time by the Council.

1. The degree of Master of Applied Science may be awarded by the Council on the recommendation of Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

**Master of Applied
Science (MAppSc)**

*Or department where a department is not within a School

Qualifications	<p>2. (1) An applicant for registration for the degree shall normally be a graduate from an appropriate four-year, full-time undergraduate course in the University or other approved university or tertiary institute.</p> <p>(2) The Committee may consider applications from graduates of three-year, full-time courses in the University or other approved university or tertiary institute who have satisfactorily completed an approved qualifying program of not less than one year full-time or its equivalent or have submitted evidence of attainment in appropriate graduate studies extending over a period of not less than one full-time year or its equivalent.</p> <p>(3) The Committee may also consider applications from graduates of the Bachelor of Science (Technology) and Bachelor of Science (Engineering) courses of the University who have satisfactorily completed an approved qualifying program of not less than one year part-time or who can submit evidence of academic attainment in appropriate graduate studies extending over the same period or its equivalent.</p> <p>(4) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and taking such examinations as the Committee may determine.</p>
Registration and Progression	<p>3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two months before the commencement of the course.</p> <p>(2) A candidate for the degree shall be required to undertake such course of formal study, pass such examinations and, where specified, submit a report on a project, as prescribed by the Committee.</p> <p>(3) No candidate shall be considered for the award of the degree until the lapse of two sessions in the case of a full-time candidate or four sessions in the case of a part-time candidate from the date from which registration becomes effective. The Committee may approve remission of up to two sessions for a part-time candidate.</p> <p>(4) The progress of a candidate shall be reviewed annually by the Committee on the recommendation of the Head of School or Department in which the candidate is registered and as a result of such review the Committee may terminate the candidature.</p>
Project	<p>4. (1) Where specified, a report on a project approved by the Committee may be submitted at the completion of the formal section of the course, but in any case shall be submitted not later than one year after the completion of such course.</p> <p>(2) The format of the report shall accord with the instructions of the Head of School and shall comply with the requirements of the Committee for the submission of project reports.</p> <p>(3) The report shall be under the supervision of a member of the academic staff and shall be examined by two examiners. The satisfactory completion of the project shall be regarded as part of the annual assessment.</p>
Recommendation for Admission to Degree	<p>5. Having considered the candidate's results in the prescribed course of study, the Committee shall recommend whether the candidate may be admitted to the degree.</p>
Fees	<p>6. An approved candidate shall pay such fees as may be determined from time to time by the Council.</p>

1. The degree of Master of Engineering may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an investigation.

Master of Engineering (ME)

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved university, in an appropriate school.

Qualifications

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainment as may be approved by the Professorial Board on the recommendation of the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

Registration

(2) In every case, before permitting an applicant to register as a candidate, the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

- (a) student in full-time attendance at the University
- (b) student in part-time attendance at the University
- (c) student working externally to the University

(4) Every candidate for the degree shall be required to carry out a program of advanced study to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) No candidate shall be considered for the award of the degree until the lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may, with the approval of the Committee, be reduced by up to two sessions.

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph 3. (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work the candidate has published whether or not such work is related to the thesis.

Thesis

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Committee one of whom shall, if possible, be an external examiner.

(3) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Fees

Master of Environmental Studies (MEnvStudies)

1. The degree of Master of Environmental Studies may be awarded on the recommendation of the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed a program of advanced study comprising formal course work and the submission of a report on a project approved by the Committee.

Qualifications

2. (1) An applicant for registration for the degree shall normally be a graduate from an appropriate four-year full-time undergraduate course in the University or other approved university or tertiary institution.

(2) An applicant may also be permitted to register as a candidate for the degree on the submission of evidence of such academic or professional attainments as may be approved by the Committee.

(3) Notwithstanding any other provisions of these conditions the committee may require an applicant to demonstrate fitness for registration by carrying out such work and taking such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree of Master shall be made on the prescribed form which shall be lodged with the Registrar at least two (2) months before the commencement of the course.

(2) A candidate for the degree shall be required to undertake such course of formal study, pass such examinations and submit a report on a project as prescribed by the Committee.

(3) No candidate shall be considered for the award of the degree until the lapse of two sessions in the case of a full-time candidate or four sessions in the case of a part-time candidate from the date from which registration becomes effective.

(4) The progress of a candidate shall be reviewed annually by the Committee and as a result of such review the Committee may terminate the candidature.

Project

4. (1) A report on a project approved by the Committee shall be submitted at the completion of the formal section of the course, but in any case not later than one year after the completion of such course.

(2) The format of the report shall accord with the requirements of the Committee for the submission of project reports.

(3) (a) The report shall be examined by two examiners appointed by the Committee;

(b) A candidate may be required to attend for an oral or written examination.

Recommendation for Admission to Degree

5. Having considered the examiners' report and the candidate's other results in the prescribed course of study, the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc)

1. The degree of Master of Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty or Board of Studies (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved University in an appropriate School or Department.

Qualifications

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments as may be approved by the Professorial Board on the recommendation of the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

3. (1) An application to register as a candidate for the degree of Master of Science shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

Registration

(2) In every case before permitting an applicant to register as a candidate the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(c) student working externally to the University

(4) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an original investigation or design, to take such examinations and to perform such other work as may be prescribed by the Committee. This work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) At least once a year and at any other time that the Committee sees fit the candidate's supervisor shall present to the Head of School in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and as a result of its review may cancel registration or take such other action as it considers appropriate.

(6) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of four complete sessions from the date of registration, save that the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may be reduced by up to two sessions with the approval of the Committee. A candidate who is fully engaged in research for the degree shall present for examination not later than six academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the Committee.

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph 3. (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit also for examination any work the candidate has published whether or not such work is related to the thesis.

Thesis

(2) For each candidate there shall be at least two examiners, appointed by the Professorial Board on the recommendation of the Committee, one of whom, if possible, shall be external to the University.

(3) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.

**Recommendation for
Admission to Degree**

Fees

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

**Master of Science (MSc)
and Master of
Engineering (ME) without
supervision**

Qualifications

Registration

Thesis

1. Where it is not possible for candidates to register under the normal conditions for the degree of Master of Science, Master of Engineering or Master of Surveying by reason of their location at centres which are distant from University Schools or where effective supervision is not practicable registration may be granted in these categories under the following conditions:

2. An applicant for registration shall have been admitted to a degree of Bachelor in the University of New South Wales.

3. (1) An application to register as an external candidate for the degree of Master of Science, Master of Engineering or Master of Surveying without supervision shall be lodged with the Registrar for recommendation by the Head of School and consideration by the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his own interest at an early stage, seek the advice of the appropriate School with regard to the adequacy of the subject matter for the degree. A synopsis of the work should be enclosed.

(2) A candidate shall not be considered for the award of the degree until the lapse of six sessions in the case of honours graduates and eight sessions in the case of pass graduates from the date of graduation.

4. (1)(a) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an investigation or design. The thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. A candidate may submit also for examination any work the candidate has published, whether or not such work is related to the thesis.

(b) Every candidate shall submit with the thesis a statutory declaration that the material contained therein is the candidate's own work, except where otherwise stated in the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall be an internal examiner.

(3) If the thesis reaches the required standard, the candidate shall be required to attend for an oral examination at a time and place nominated by the Committee. The examiners may also arrange at their discretion for the examination of the candidate by written and/or practical examinations on the subject of the thesis and/or subjects related thereto.

(4) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

**Recommendation for
Admission to Degree**

Fees

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

6. An approved applicant shall pay such fees as may be determined from time to time by the Council.

**Graduate Diploma
(GradDip)**

1. An application for admission to a graduate diploma course shall be made on the prescribed form which should be lodged with the Registrar at least two full calendar months before the commencement of the course.
2. An applicant for admission to a graduate diploma course shall be:
 - (1) a graduate of the University of New South Wales or other approved university.
 - (2) a person with other qualifications as may be approved by Faculty.
3. Notwithstanding clause 2. above, Faculty may require an applicant to take such other prerequisite or concurrent studies and/or examinations as it may prescribe.
4. Every candidate for a graduate diploma shall be required to undertake the appropriate course of study, to pass any prescribed examinations, and if so laid down in the course, to complete a project or assignment specified by the Head of the School. The format of the report on such project or assignment shall accord with the instructions laid down by the Head of the School.
5. An approved applicant shall be required to pay the fee for the course in which the applicant desires to register. Fees shall be paid in advance.

Subject Descriptions

Identification of Subjects by Number

A subject is defined by the Professorial Board as 'a unit of instruction approved by the University as being a discrete part of the requirements for a course offered by the University'.

Each approved subject of the University is identifiable both by number and by name as this is a check against nomination of subject other than the one intended.

Subject numbers are allocated by the Registrar and the system of allocation is based on the following guidelines:

1. The authority offering the subject, normally a School of the University, is indicated by the number before the decimal point.
2. Each subject number is unique and is not used for more than one subject title.
3. Subject numbers which have not been used for some time are not used for new subject titles.
4. Graduate subjects are indicated by a suffix 'G' to a number with three digits after the decimal point. In other subjects three or four digits are used after the decimal point.

Subjects taught are listed in full in the handbook of the faculty or board of studies responsible for the particular course within which the subjects are taken. Subject descriptions are contained in the appropriate section of the handbooks.

Details of subjects available in Faculty of Applied Science courses but not included in this list may be obtained from the School responsible for the subject. Details of subjects in the Faculty of Arts which may be taken as humanities subjects may be found in the current Arts Faculty Handbook.

The identifying numerical prefixes for each subject authority are set out below.

Servicing Subjects are those taught by a School or Department outside its own faculty and are listed at the end of **Undergraduate Study** and **Graduate Study** of the relevant School. Their subject descriptions are published in the handbook of the Faculty in which the subject is taught.

HSC Exam Prerequisites

Subjects which require prerequisites for enrolment in terms of the HSC Examination percentile range, refer to the **1978 and subsequent Examinations**.

Candidates for enrolment who obtained the HSC in previous years or hold other high school matriculation should check with the appropriate School on what matriculation status is required for admission to a subject.

Information Key

The following is the key to the information supplied about each subject: S1 (Session 1); S2 (Session 2); F (Session 1 *plus* Session 2, ie full year); S1 or S2 (Session 1 or Session 2, ie choice of either session); SS (single session, ie which session taught is not known at time of publication); L (Lecture, followed by hours per week); T (Laboratory/Tutorial, followed by hours per week); Sem (Seminar, followed by hours per week) hpw (hours per week); C (Credit or Credit units), CR (Credit Level), DN (Distinction); R (after subject number) Broken Hill syllabus.

	School, Department etc	Faculty	Page		School, Department etc	Faculty	Page
1	School of Physics*	Science	84	43	School of Botany*	Biological Sciences	132
2	School of Chemistry*	Science	85	44	School of Microbiology*	Biological Sciences	133
4	School of Metallurgy	Applied Science	87	45	School of Zoology*	Biological Sciences	133
5	School of Mechanical and Industrial Engineering*	Engineering	92	46	Faculty of Applied Science	Applied Science	134
6	School of Electrical Engineering and Computer Science*	Engineering	94	48	School of Chemical Engineering and Industrial Chemistry	Applied Science	135
7	School of Mining Engineering	Applied Science	95	50	School of English	Arts	
8	School of Civil Engineering*	Engineering	100	51	School of History	Arts	
9	School of Wool and Pastoral Sciences	Applied Science	102	52	School of Philosophy	Arts	
10	School of Mathematics*	Science	105	53	School of Sociology*	Arts	147
11	School of Architecture	Architecture		54	School of Political Science*	Arts	148
12	School of Psychology*	Biological Sciences	107	55	School of Librarianship	Professional Studies	
13	School of Textile Technology	Applied Science	107	56	School of French	Arts	
14	School of Accountancy*	Commerce	108	57	School of Drama	Arts	
15	School of Economics*	Commerce	109	58	School of Education	Professional Studies	
16	School of Health Administration	Professional Studies		59	School of Russian	Arts	
17	Biological Sciences*	Biological Sciences	111	60	Faculty of Arts	Arts	
18	School of Mechanical and Industrial Engineering (Industrial Engineering)*	Engineering	111	62	School of History and Philosophy of Science	Arts	
21	Department of Industrial Arts	Architecture		63	School of Social Work	Professional Studies	
23	School of Nuclear Engineering*	Engineering	111	64	School of German Studies	Arts	
25	School of Applied Geology	Applied Science	112	65	School of Spanish and Latin American Studies	Arts	
26	Department of General Studies	Board of Studies in General Education		66	Subjects Available from Other Universities		
27	School of Geography	Applied Science	118	68	Board of Studies in Science and Mathematics	Board of Studies in Science and Mathematics	
28	School of Marketing*	Commerce	124	70	School of Anatomy	Medicine	
29	School of Surveying*	Engineering	124	71	School of Medicine	Medicine	
30	Department of Organizational Behaviour*	Commerce	125	72	School of Pathology	Medicine	
31	School of Optometry	Science		73	School of Physiology and Pharmacology	Medicine	
32	Centre for Biomedical Engineering	Engineering		74	School of Surgery	Medicine	
35	School of Building	Architecture		75	School of Obstetrics and Gynaecology	Medicine	
36	School of Town Planning*	Architecture	125	76	School of Paediatrics	Medicine	
37	School of Landscape Architecture*	Architecture	125	77	School of Psychiatry	Medicine	
38	School of Food Technology	Applied Science	126	79	School of Community Medicine	Medicine	
39	Graduate School of the Built Environment*	Architecture	130	80	Faculty of Medicine	Medicine	
40	Professorial Board			81	Medicine/Science/Biological Sciences	Medicine	
41	School of Biochemistry*	Biological Sciences	131	85	Australian Graduate School of Management*	AGSM	148
42	School of Biotechnology*	Biological Sciences	131	90	Faculty of Law	Law	
				97	Division of Postgraduate Extension Studies		

*Offers subjects for courses outlined in this handbook.

School of Physics

Undergraduate Study

Physics Level I units

1.001 Physics I

F L3T3

Prerequisites:

*HSC Exam Percentile
Range Required*

2 unit Mathematics or 3 unit Mathematics or 4 unit Mathematics and 2 unit Science (incl. Physics and/or Chem.) or 4 unit Science (incl. Physics and/or Chem.)	71-100 21-100 1-100 31-100 31-100
---	---

Co-requisites: 10.021C or 10.001 or 10.011.

Aims and nature of physics and the study of motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Concepts of force, inertial mass, energy, momentum, charge, potential, fields. Application of the conservation principles to solution of problems involving charge, energy and momentum. Electrical circuit theory, application of Kirchhoff's Laws to AC and DC circuits. Uniform circular motion, Kepler's Laws and rotational mechanics. Properties of matter: solids, liquids, gases. The wave theories of physics, transfer of energy by waves, properties of waves. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarization.

1.011 Higher Physics I

F L3T3

Prerequisite: As for 1.001. *Co-requisite:* 10.001 or 10.011.

For students of all Faculties except Medicine who have a good secondary school record and who wish to do a more challenging course. Entry to this course requires permission from the Head of the School of Physics.

Vector algebra, kinematics, uniform circular motion, coriolis acceleration, dynamics of particles, motion in a resistive medium, work and energy, gravitation, rotational motion of rigid bodies about fixed axis, rotational motion about a fixed point. Lagrange and Hamilton equations, harmonic motions, waves in elastic media. Sound waves, physical optics, polarization and double refraction.

Electric charge, electric intensity, electric flux, Gauss' law, electric potential, capacity, dielectric materials, electric current and resistance, DC circuits, magnetic field, field due to a current, electromagnetic induction, inductance, magnetic materials, transients, AC circuits, electronics, diode, rectifier circuit, simple power supplies, electronic amplifier systems, single loop feedback systems, signal processing circuits using operational amplifiers.

1.021 Introductory Physics I (For Health and Life Scientists)

F L3T3

Co-requisites: 10.021A and 10.021B, or 10.021B and 10.021C, or 10.021 or 10.001 or 10.011.

An introductory subject in physics designed principally for students majoring in the life and health science disciplines. Discusses the following topics at an introductory level:

The methods of physics, describing motion, the dynamics of a particle, conservation of energy, kinetic theory of gases, properties of liquids, vibrations and waves, electricity and conduction in solids, ions and ionic conduction, magnetism and electromagnetic induction, alternating current, atomic nature of matter, X-rays, the nucleus and radioactivity, electronics, geometrical optics, optical instruments, wave optics, microscopes and their uses.

Physics Level II units

1.012 Mechanics and Thermal Physics

S1 L3T2

Prerequisites: 1.001 or 1.011, 10.001. *Co-requisites:* 10.2111.

Excluded: 10.411B, 10.421B.

Properties of solids and liquids, elasticity, hydrostatics, hydrodynamics, damped and forced vibrations, resonance, coupled systems, normal modes, Fourier analysis, waves, group velocity, reflection and transmission at a boundary.

Kinetic theory, Maxwell velocity distribution, transport coefficients, first and second laws of thermodynamics, thermodynamic functions, simple applications, microscopic approach to thermodynamics, Boltzmann probability.

1.022 Electromagnetism and Modern Physics

S2 L3T2

Prerequisites: 1.001 or 1.011, 10.001. *Co-requisites:* 10.2111. *Excluded:* 1.9322.

Electrostatics in vacuum and in dielectrics, Gauss' law, current density, magnetostatics in vacuum and in magnetic materials, electromagnetic induction, displacement current, Maxwell's equations, simple solutions, applications.

Special theory of relativity, Lorentz transformation, simultaneity, relativistic mass, momentum and energy, formalism of wave mechanics, Schrodinger's equation, simple solutions, hydrogen atom, spectra, electron spin, selection rules, exclusion principle, Zeeman effect molecules.

1.032 Laboratory

F T3

Prerequisite: 1.001 or 1.011, 10.001. *Excluded:* 1.9222.

Alternating current circuits, complex impedance, resonance, mutual inductance, introductory electronics, diode characteristics and circuits, power supplies, transistor characteristics, single stage and coupled amplifiers, experiments using AC circuits. Experimental investigations in a choice of areas including radioactivity, spectroscopy, properties of materials, Hall effect, nuclear magnetic resonance, photography, vacuum systems.

Terminating Physics Level II units

1.9222 Electronics

S1 L1T2

Prerequisites: 1.001 or 1.011 or 1.021, 10.001 or 10.011 or 10.021B and 10.021C.

The application of electronics to other disciplines. Principles of circuit theory and analogue computing; amplifiers, their specification and application; transducers; electronic instrumentation; industrial data acquisition.

1.9322 Introduction to Solids

S2 L2T1

Prerequisites: 1.001 or 1.011 or 1.021, 10.001 or 10.011 or 10.021B and 10.021C. *Excluded:* 1.022, 4.402, 4.412.

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

Physics Level III units

1.013 Quantum Mechanics and Nuclear Physics

F L1½T½

Prerequisites: 1.012, 1.022, 10.2111, 10.2112. *Excluded:* 2.023A, 10.222F.

Concepts and formulation, expectation values and measurement, steps, wells, and barriers, tunnelling, harmonic oscillator, perturbation theory, hydrogen atom, angular momentum operators, spin and spin orbit coupling, vector model, fine structure, identical particles, helium atom, spectroscopy, electron states in molecules and solids. Detecting instruments for nuclear particles, counting statistics, Rutherford scattering, radioactivity, radiative processes, reactions, optical model, parity, introduction to particle physics, mesons, baryons, quarks.

Additional material is studied for the award of Distinction/High Distinction.

1.023 Statistical Mechanics and Solid State Physics

S1 L3T1

Prerequisites: 1.012, 1.022, 10.2111, 10.2112. *Co-requisite:* 1.013 or 2.023A.

Canonical distribution, paramagnetism, Einstein solid, ideal gas, equipartition, grand canonical ensemble, chemical potential, phase equilibria, Fermi and Bose statistics, Bose condensation, blackbody radiation. Crystal structure, bonding, lattice dynamics, phonons, free-electron model of metals, band theory, point defects, dislocations.

Additional material is studied for the award of Distinction/High Distinction.

1.033 Electromagnetism and Optical Physics

S2 L3T1

Prerequisites: 1.012, 1.022, 10.2111, 10.2112. *Excluded:* 10.222C.

Wave equation, reflection and transmission at dielectric, metallic and plasma interfaces, Fresnel equations, skin depth, waveguides and cavities, radiation fields, dipole and long antenna. Fourier theory, diffraction from rectangular and circular apertures, interference and

interferometry, coherence, image formation, resolution, holography, Fourier transform spectroscopy.

Additional material is studied for the award of Distinction/High Distinction.

1.043 Experimental Physics A

F T4

Prerequisites: 1.012, 1.022, 1.032.

Basic experimental techniques and analysis of results in the following areas of physics: electricity, magnetism, diffraction optics (including X-ray and electron diffraction, solid state physics, nuclear physics, atomic physics and spectroscopy, vacuum systems).

School of Chemistry

Undergraduate Study

2.002A Physical Chemistry

S1 or S2 L3T3

Prerequisites: 2.121 or 2.141 and 10.011 or 10.001 or 10.021B & 10.021C.

Thermodynamics: First, second and third laws of thermodynamics; statistical mechanical treatment of thermodynamic properties; applications of thermodynamics; chemical equilibria, phase equilibria, solutions of non-electrolytes and electrolytes, electrochemical cells.

Kinetics: Order and molecularity; effect of temperature on reaction rates; elementary reaction rate theory.

Surface Chemistry and Colloids: Absorption, properties of dispersions; macromolecules and association colloids.

2.002B Organic Chemistry

S1 or S2 L3T3

Prerequisite: 2.131 or 2.141.

Chemistry of the more important functional groups: aliphatic hydrocarbons, monocyclic aromatic hydrocarbons, halides, alcohols, phenols, aldehydes, ketones, ethers, carboxylic acids and their derivatives, nitro compounds, amines, and sulphonic acids.

2.002D Analytical Chemistry

S1 or S2 L2T4

Prerequisites: 2.121 & 2.131, or 2.141, 10.011 or 10.001 or 10.021B & 10.021C.

Chemical equilibria in analytical chemistry. Acid-base, complex formation, redox systems, solid/solution, and liquid/liquid equilibria with

applications to volumetric, gravimetric and complexometric analysis, and to liquid/liquid extractions. Spectrophotometry, basic principles. Chromophores. Fundamentals of precision. Electrochemistry, theory and applications to electrodeposition and potentiometry; ion selective electrodes. Radioactive tracer techniques. Data evaluation in analytical chemistry. Qualitative analysis.

2.003B Organic Chemistry

S1 or S2 L2T4

Prerequisite: 2.002B.

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

Heterocyclic Chemistry: Synthesis and reactions of the following hetero-aromatic systems: pyridine, quinoline, isoquinoline. Flavones and isoflavones; pyrimidine; pyrrole, furan, thiophen, indole, imidazole.

2.003H Molecular Spectroscopy and Structure

S2 L3T3

Prerequisites: 2.121 & 2.131, or 2.141.

Absorption and emission of radiation. Atomic spectra. Molecular spectroscopy: vibrational, including infrared and Raman; UV-visible; instrumentation and sample handling. Magnetic resonance. Mass spectrometry with particular reference to structure determination. Laboratory and tutorial work to illustrate the above, including inspection of major instruments.

2.003J Fundamentals of Biological and Agricultural Chemistry

L2T4

Prerequisites: 2.121 & 2.131, or 2.141. *Excluded:* 2.013L, 41.101.

Aspects of the chemical and physical properties of materials important in biological systems. Methods of separation, of purification and estimation, and correlations of structure with reactivity.

Methods of separation and identification, such as gel permeation, discussed as appropriate to each topic.

Significance of isomerism in biological systems, optical and geometrical, absolute configuration. Amino acids, peptides and introduction to protein structure. Relevant properties, acid/base properties, pK values, zwitterion, isoelectric points. Simple peptide synthesis.

Treatment of carbohydrates, establishment of structures, reactivity. Chemistry of monosaccharides, disaccharides and polysaccharides. Methods of analysis, chemical and physicochemical.

Fats, correlation of properties with saturated and unsaturated fatty acid composition. Structural chemistry of fatty acids. Reaction of unsaturated fatty acids, urea complexes. Detergents.

Trace elements in biological systems. Chemistry of common heterocyclic systems with emphasis on molecules of biological importance.

2.013L Chemistry and Enzymology of Foods F L1T2

Prerequisite: 2.002B. *Excluded:* 2.023L, 2.043L, 2.053L.

The chemistry of food constituents at an advanced level and the relationship between the chemistry and enzymology associated with the

origin and handling of foodstuffs. Treatment of the stability of constituents, changes in colour and texture occurring during processing and storage. Methods of assessment, chemical and physical.

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

2.030 Organic Chemistry

S1 L1P4 S2 L1

Prerequisite: 2.002B.

The spectroscopic identification of organic compounds, free radical chemistry and electro-organic processes, various aspects of the organic industrial processes such as industrial synthesis based on petrochemicals, and organometallic reactions of industrial interest. Selected topics from the dyestuff, pharmaceutical and agricultural industries discussing syntheses and reactions including degradation.

2.042C Inorganic Chemistry

S1 or S2 L2T4

Prerequisites: 2.121 & 2.131, or 2.141.

Chemistry of the non-metals, including B, C, Si, N, P, S, Se, Te, halogens, and noble gases. Chemistry of the metals of groups IA, IIA and Al. Typical ionic, giant-molecule and close packed structures. Transition metal chemistry, including variable oxidation states, paramagnetism, Werner's theory, isomerism of six- and four-coordinate complexes, chelation, stabilization of valency states. Physical methods of molecular structure determination. Chemistry of Fe, Co, Ni, Cu, Ag, Au.

2.043A Environmental Chemistry

C6

Prerequisites: 2.002A, 2.002D.

Physico-chemical aspects of atmosphere chemistry, dispersion of colloids and solid matter, photochemical reactions. Hydrological cycle; reactions in the sea, rivers and estuaries, chemical characteristics of surface and sub-surface water. Corrosion of metals.

and either

Simple digital and analogue computer models of ecological systems based on chemical data and physico-chemical properties.

or

Distribution of elements and nutrient cycles in water; organic carbon cycles, oxygen balance (redox processes in aquatic systems). Chemical models of these processes (including an introduction to simple computing). Practical project mostly field work) dealing with nutrient cycles.

2.043L Chemistry and Enzymology of Foods

Prerequisite: 2.002B. *Excluded:* 2.013L, 2.023L, 2.053L.

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

2.111 Introductory Chemistry†

S1 L2T4

Prerequisite: Nil.

Classification of matter and the language of chemistry. The gas laws and the Ideal Gas Equation, gas mixtures and partial pressure. The structure

of atoms, cations and anions, chemical bonding, properties of ionic and covalent compounds. The Periodic classification of elements, oxides, hydrides, halides of selected elements. Acids, bases, salts, neutralisation. Stoichiometry, the mole concept. Electron transfer reactions. Qualitative treatment of reversibility and chemical equilibrium, the pH scale. Introduction to the diversity of carbon compounds.

2.121 Chemistry IA† S1 or S2 L2T4

Prerequisites:	HSC Exam Percentile Range Required
2 unit Mathematics	71-100
or	
3 unit Mathematics	21-100
or	
4 unit Mathematics	1-100
and	
2 unit Science (Physics or Chemistry)	31-100
or	
4 unit Science (multistrand)	31-100
or	
2 unit Science (other than Physics or Chemistry)	51-100
or	
2.111.	

Stoichiometry and solution stoichiometry. Structure of matter, solids, liquids, gases. Thermochemistry. Equilibria and equilibrium constants, entropy changes, free energy changes, the relationship between equilibrium and standard free energy changes. Ideal solutions, colligative properties. Equilibrium in electrolyte solutions, acid-base equilibria, solubility equilibria, and redox equilibria. The rate of a chemical change and chemical kinetics.

2.131 Chemistry IB S1 or S2 L2T4

Prerequisite: 2.111 or 2.121.

Relative stability of oxidation states. Electronic structure of atoms in terms of the quantum mechanical model. Structure of the Periodic Table and its relationship to electronic configuration. Chemical bonding, hybridization. Properties of compounds of selected elements, acid-base character of oxides and hydroxy compounds. Chemistry of carbon compounds, stereoisomerism, reactions of aliphatic and aromatic hydrocarbons, alcohols, phenols, ethers, alkyl halides, aldehydes, ketones, carboxylic acids and their derivatives, esters, acyl halides, anhydrides, amides, amines.

2.141 Chemistry IM† F L2T4

Prerequisites:	HSC Exam Percentile Range Required
2 unit Mathematics	71-100
or	
3 unit Mathematics	21-100
or	
4 unit Mathematics	1-100
and	
2 unit Science (Physics or Chemistry)	51-100
or	
4 unit Science (multistrand)	51-100
or	
2 unit Science (other than Physics or Chemistry)	51-100
or	
2.111	

This is an integrated syllabus of 2.121 and 2.131.

†Students who have passed 2.121 or 2.131 may not enrol in 2.111 or 2.141. Students meeting the 2.121 or 2.141 prerequisite are not permitted to enrol in 2.111 without permission of the Head of the School of Chemistry. Once students enrol in 2.111 they must pass 2.111 before proceeding to 2.121 or 2.131 or 2.141.

Graduate Study

2.251G Toxicology, Occupational and Public Health

F L1T2 C6

Important classes of toxic materials found in the environment, treatment of pesticide residues, industrial chemicals of various types, toxic gases, mould metabolites and bacterial toxins occurring in food, carcinogenic substances, toxic metals etc. Effects of these substances on living organisms, particularly man. Practical work: pesticide residue analysis blood and urine analysis, gas sampling analysis, trace metal determination and experiments on the animal metabolism of toxic substances.

2.271G Chemistry and Analysis of Foods

Illustrates the bases and application of analytical techniques as applied to foods. Emphasis is placed on the design of methods, on the preparation of material for instrumental analysis and on the interpretation of data.

Subject matter includes: proteins and flesh foods, carbohydrates and saccharine foods, fats and oils, dairy and fermentation products, vitamins, food additives — preservatives and colouring matters, pesticide residues, metal contaminants — food microscopy.

School of Metallurgy

Undergraduate Study

4.001 Introduction to Materials Science S1 or S2 L1

Forms part of 5.010 Engineering A.

The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

4.002 Introduction to Metallurgical Engineering S2 L2

Forms part of 5.030 Engineering C.

History and significance of the exploitation of metals. Ores, mineral economics, mineral processing, and metal extraction and processing methods illustrated by reference to the Australian mineral and metal industries. Properties, uses, and applications of metallic materials. The role of the metallurgist in industry and in processing and materials research, and in relation to conservation and the environment.

4.024 Metallurgy Project S1 6 S2 3

An experimental investigation of some aspects of metallurgy. Includes three weeks laboratory work during the mid-year recess.

4.034 Industrial Metallurgy Project F3

An experimental investigation of some aspects of industrial metallurgy.

4.054 Metallurgy Seminar F L2

Lectures on the preparation and presentation of technical papers. Each student is required to prepare and present a paper on a nominated subject.

4.121 Principles of Metal Extraction L2T1

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

4.131 Principles of Physical and Mechanical Metallurgy L3T0

A condensed treatment of physical and mechanical metallurgy.

4.141 Experimental Techniques in Physical Metallurgy LOT2

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

4.202 Ceramic Materials F L1

History of ceramics, introduction to ceramic raw materials, processing of ceramics including forming, drying, firing, introduction to crystal chemistry and phase changes in ceramics, the nature and properties of crystalline ceramic glasses, ceramic fibres and composites.

4.213 Chemical Ceramics S1 L3T3 S2 L2T3

Prerequisites: 2.002A, 2.002C, 2.002D. *Co- or prerequisites:* 4.233, 22.123A, 25.541.

Structural principles: crystal chemistry, structure of glasses, defect solid state: phase equilibria and transformations; diffusion; solid state reactions. A systematic treatment of the chemistry of ceramic products.

Students are required to take part in a series of factory inspections.

4.224 Physical Ceramics F L2T4

Prerequisites: 4.213, 4.233.

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.

4.231 Introduction to Ceramic Engineering S2 L2

4.231 is an option in 5.030 Engineering C.

The nature of ceramics. The scope of ceramic industry. The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials. Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, hot forming and other forming procedures.

4.232 Ceramic Engineering I S2 L3

Co- or prerequisites: 48.311, 7.023.

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.

4.233 Ceramic Process Principles F L1T2½

Review of raw materials and principal unit operations used in the ceramic industry. Plasticity in a clay-water system. Drying and firing calculations. Polymorphism. Firing and heat transfer considerations. Effect of porosity on fired ceramics. Calculations involving ceramic suspensions. Glass, glaze and porcelain enamel calculations. Relationship between the composition and physical properties of glasses. Rational analysis of clay and fluxing materials. Body formulation. Testing methods and instrumentation in quality control.

Students are required to take part in a series of factory inspections.

4.234 Ceramic Engineering II F L2T2

Prerequisites: 48.311, 4.233, 4.232, 8.112.

Advanced treatment of fluid flow and heat transfer: non-Newtonian fluids and unsteady-state heat transfer. A detailed study of ceramic engineering unit operations: filtration, forming, drying and firing. Ceramic engineering design including design of dryers, kilns and glass tanks. Design of simple steel structures. Pollution control equipment.

Students are required to take part in a series of factory inspections.

4.294 Project (Ceramic Engineering) S1 T6 S2 T9

An experimental or technical investigation or design related to some aspect of ceramic engineering. *Prerequisites* and/or *co-requisites* are determined depending on the nature of the project.

4.302 Chemical and Extraction Metallurgy I L1T2

Co-requisite: 2.002A.

Metal extraction from ores in terms of unit operations and overall systems, illustrated by the extraction of iron, copper, aluminium and other metals. Elementary process analysis. Laboratory — analysis and solution of problems.

4.303 Chemical and Extraction Metallurgy II L3T2

Prerequisites: 4.302, 4.602 and 4.402 or 4.412.

Metallurgical thermodynamics, application to equilibria involving liquid metals, slags, gases and the solid state. Electrochemistry; corrosion; hydrometallurgy. Kinetics applied to metallurgical processes. Process assessment and selection.

4.312 Chemical and Extraction Metallurgy IA S1 L1T0 S2 L2T3

Co-requisites: 2.002A.

As for subject 4.302 above.

4.314 Chemical and Extraction Metallurgy IIIA S1 L3 T1½

Prerequisite: 4.303.

Kinetics of interphase transfer in metallurgical systems. Advances in pyrometallurgy, related to fuel utilization, agglomeration, emission, recycling. Advances in hydrometallurgy. Corrosion and oxidation, selection of materials.

4.324 Chemical and Extraction Metallurgy IIIB S2 L3½T1

Prerequisite: 4.303.

A selection of advanced topics in chemical and extractive metallurgy.

4.374 Metal Extraction Processes L2T1

Analysis of pyrometallurgical and hydrometallurgical extraction and refining processes using the principles of chemical equilibrium and kinetics.

Extraction and refining processes for commercially important ferrous and non-ferrous metals.

Nature of the inter-relationship between raw material, extraction process and product characteristics. Economic factors in process selection and operation; acceptance standards for ores and concentrates, smelter charges; penalties and bonuses; by-products.

4.402 Physical Metallurgy I S1 L3T3 S2 L2T4

Co-requisites: 2.002A, 4.502. *Excluded:* 1.932, 4.412, 4.422.

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. X-ray diffraction. Phase equilibrium in alloy systems. The genesis of microstructure. Mechanisms of phase transformations, departures from equilibrium, metastable transition phases. Heat treatment of alloys. Structure of carbon steels and cast irons. Optical metallography.

4.403 Physical Metallurgy II L4T5

Prerequisite: 4.402.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of

commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Zone theory of solids — application to electrical, thermal and magnetic properties and to theory of alloys. Preferred orientation in metals. Optical, X-ray and electron metallography.

4.404 Physical Metallurgy III S1 L3T4½ S2 L3T1½

Applications of dislocation theory to work hardening and annealing processes. Phase transformations in alloys. Mathematical crystallography, reciprocal lattice, diffraction. Electron and X-ray metallography.

Selection of advanced topics in physical metallurgy including radiation damage, martensitic transformations, neutron diffraction, internal friction, sintering, creep, superelasticity, fracture, microplasticity.

4.412 Metallurgical Phases— Structure and Equilibrium, Part 1 S1 L3T3

Co-requisite: 2.002A. *Excluded:* 1.932, 4.402.

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. Phase equilibrium in alloy systems. The genesis of microstructure. Metallography.

4.414 Physical Metallurgy IIIA S1 L3T1½

Prerequisite: 4.403.

Applications of dislocation theory to work hardening and annealing processes. Phase transformations in alloys. Mathematical crystallography, reciprocal lattice, diffraction. Electron and X-ray metallography.

4.422 Metallurgical Phases — Structure and Equilibrium, Part 2 S2 L2T4

Prerequisite: 4.412. *Excluded:* 4.402.

X-rays and X-ray diffraction. Mechanism of phase transformations, departures from equilibrium, metastable transition phases. Principles of heat treatment. Optical and X-ray examination of metallurgical materials.

4.424 Physical Metallurgy IIIB S1 L0T3 S2 L3T1½

Prerequisite: 4.403.

Selection of advanced topics in physical metallurgy including radiation damage, martensitic transformations, neutron diffraction, internal friction, sintering, creep, superelasticity, fracture, microplasticity.

4.433 Physical Metallurgy IIC S1 L4T5 S2 L3T3

Prerequisite: 4.402.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Optical, X-ray and electron metallography. Preferred orientation in metals.

4.502 Mechanical Metallurgy S1 L2T2 S2 L1T2

Combination of 4.512 and 4.522.

4.512 Mechanical Properties of Solids S1 L2T2

Co-requisite: 4.402.

The nature and significance of mechanical properties. Analysis of stress and strain. Stress/strain/time relationships. Influence of stress, state, temperature, strain rate and environment on mechanical behaviour. Modes of failure under load. Mechanical testing.

4.522 Mechanical Metallurgy S2 L1T2

Prerequisite: 4.512.

Flow and fracture in metals. Plasticity theory. Principles of metal shaping processes. Relationship between formability and conventional mechanical test results. Fracture mechanics. Fractography. Defects and their significance. Experimental methods related to stress analysis, flow and fracture.

4.504 Mechanical and Industrial Metallurgy S1 L3T0 S2 L3T6

Prerequisites: 4.403 or 4.433, 4.503.

The application of metallurgical principles to industrial processing with particular reference to casting, welding, shaping, properties and selection of materials. Metal finishing. Metallurgical aspects in engineering design. Fracture mechanics, design against fatigue, brittle and ductile fracture.

4.514 Industrial Metallurgy F3

Prerequisites: 4.433, 4.503.

Description as for subject 4.504.

4.602 Metallurgical Engineering I S2 L3T2

Co-requisite: 4.302.

Mass and energy accounting in metallurgical processes. An introduction to the principles and applications of transport processes in systems with specific reference to industrial processes in primary and secondary metallurgy.

4.604 Metallurgical Engineering III S1 L4T2 S2 L3T6

Prerequisite: 4.623.

Process dynamics and automatic control. Dynamics of simple linear systems; representation and analysis of metallurgical processes by linear models; effect of various control elements; analysis by empirical models; design of control systems for metallurgical processes, atmospheric and water pollution control. Optimization: as for 48.042 Chemical Engineering IIIB, Unit 3.

Industrial Practice: Case studies, design studies and assignments related to industrial practice and integrated process schemes for metal extraction, refining, fabrication, treatment and finishing.

4.613 Metallurgical Engineering IIA S1 L2T1

Prerequisite: 4.602.

An extension of the principles and applications of transport processes to metallurgical systems. The principles of metallurgical heating and cooling including fuels, refractories and furnace design and operation. Solidification in moulds, continuous casting.

Process Economics: As for 48.032 Chemical Engineering IIB Unit 4.

4.623 Metallurgical Engineering IIB S2 L3T1

Prerequisite: 4.613.

Continuous Processes: The application of theoretical models and empirical data to the design of continuous processes involving two or more phases in contact.

The principles of instrumentation and their application to research and on-stream measurement in metallurgical plants.

4.624 Metallurgical Engineering Project F3

(Includes three weeks laboratory work during the mid-year recess.) An experimental investigation of some aspects of metallurgical engineering.

4.703 Materials Science S2 L2T1

Co-requisite: 4.403.

The application of the principles of physical metallurgy to the development of modern materials. Particular attention is paid to the structure property relationships that determine the design of materials. The topics covered include materials used for structural purposes, high temperature applications, corrosive environments, nuclear engineering, fuel cells, magnetic applications.

4.802 Metallurgical Physics S2 L2T0

Prerequisites: 1.001 or 1.011.

Development of physical principles for application in metallurgy — theory of metal models. Sommerfeld Theory, zone theory, interaction of radiation with matter, solid state devices, instrumentation.

4.813 Mathematical Methods L2T1

Prerequisites: 10.031 or 10.211A.

1. 10.351 Statistics SM (see Engineering Handbook)
2. Numerical Methods. Simultaneous linear equations. Solution of non-linear equations. Systems of simultaneous non-linear equations; application to phase equilibria. Finite difference methods: solutions of ordinary and partial differential equations; application to heat and mass transfer. Finite element methods: application to determination of elastic stress and strains. Computing: BASIC language; programming assignments in numerical methods.

4.911 Materials Science L1T½

The atomic structure of metals. The grain structure of metals; origin; modification. Structure of alloys, theory. Structure, properties and heat

treatment of commercially important alloys based on aluminium, copper and iron in particular. Corrosion. Control of structure and properties, commercial alloys, materials selection.

4.913 Materials Science

L2T1

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

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

L1T0

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, semiconductors and insulators. Magnetic materials — structure and properties.

4.931 Metallurgy

L1½T½

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.

4.941 Metallurgy for Engineers

L1T0

Solidification of metals, defects in cast metals, casting methods. Phase equilibrium in alloys. Strengthening mechanisms in metals. Elastic and plastic deformation of crystalline materials; mechanism of slip, dislocations. Fracture mechanism, brittle fracture, fatigue and creep. Corrosion and oxidation of metals. Specification and selection of engineering alloys.

4.951 Materials Technology

L2T2

Materials selection, based on structure and properties. Equilibrium and kinetics in metallic systems. The structure of ceramics with particular reference to silicates. Structural changes. Electroplating processes considered from a theoretical and practical standpoint. Structure and testing of electro-deposits; electrochemical protection.

The structure, properties and technology of wood.

4.961 Materials and Corrosion

S1 L2

A short subject covering the theory of corrosion and materials of construction.

4.972 Materials for Mining Engineers

L1T½

Solidification of metals, structure and defects in castings and welds. Hard-facing techniques, powder metallurgical processes. Phase equilibrium in alloys and application to engineering materials. Non-equilibrium; heat treatment and modification of structure and properties. Elastic and plastic deformation. Mechanical processing. Fracture. Corrosion and corrosion protection in mining environments. Specification and selection of engineering materials.

4.974 Mining Materials

S1 L1

Specification and selection of materials. Structural and constructional materials for buildings and plant; plain carbon, low and medium alloy steels, non ferrous alloys; repair and maintenance problems. Materials for mining and minerals processing plant; corrosion and heat-resistant alloys; wear-resistant materials; repair and maintenance. Failure analysis, fracture and corrosion failures. Corrosion prevention.

Graduate Study

4.211G Metallurgical Practice

Detailed studies relating to one or more specialized areas of metallurgical practice, such as founding, welding, mineral treatment.

4.221G Advanced Metallurgical Techniques

Lectures and laboratory instruction will be offered in advanced techniques including the following: X-ray metallography; electron microscopy; electron probe microanalysis; quantitative metallography; stress and strain analysis; fracture toughness testing; metal melting and casting; mechanical testing; electrochemical technique; research techniques — physical; research techniques — chemical; mineral investigation techniques.

4.231G Advanced Theoretical Metallurgy

Covers a wide range of theoretical topics drawn from physical metallurgy, chemical and extractive metallurgy, mineral chemistry, physics of metals and mechanical metallurgy.

4.241G Graduate Metallurgy Project

An experimental or technical investigation or design related to a branch of metallurgy.

4.251G Advanced Materials Technology

Principles of materials selection. Selection of materials based on engineering design criteria. Service performance. Modes of failure. Selection based on service performance criteria. Principles of the design of materials. Materials specifications. Acceptance testing. Principles and methods of non-destructive testing. Selection of test methods. N.D.T. laboratory procedure. Service performance analysis. Service failure investigations.

4.261G Modern Microscopy of Materials S2 L1½T1½

Descriptions of light optical and electron optical instruments from the point of resolution, depth-of-field, contrast and additional data obtainable from the specimen as well as the application of these instruments to the study of materials.

4.270G Solid State and Mineral Chemistry F L2

Principles of crystal chemistry; structures of selected crystal types and glasses. Thermodynamics of solid systems; phase relations. Defects in crystals; non-stoichiometry. Solid state diffusion. Thermodynamics and kinetics of solid state reactions. Hydrothermal reactions.

Stability of compounds at elevated temperatures; effect of heat on clay minerals; hydrothermal reactions between silica and lime; volatility of compounds; reactions in nuclear fields; solid state electrolytes; biodegradation of rocks and minerals. Chemical strengthening of ceramics.

4.271G Refractory Technology I S1 or S2 L4T2

Engineering Properties and Applications: This subject deals with the philosophy and methods of development of refractories, the thermodynamic stability and volatility of high temperature materials and the manufacture and testing of refractory materials in industry. A detailed consideration is given to the composition, structure, and properties of typical refractory materials such as silica, aluminosilicate, high alumina, basic and zirconia materials and special single and mixed oxides, carbide, nitrides and oxynitrides. Furnace and kiln design is studied with respect to limitations imposed by the refractories used. Laboratory experiments and demonstrations will form part of the course.

Candidates are expected to have a background knowledge equivalent to that expressed in the syllabus for 4.232 Ceramic Engineering I.

4.272G Refractory Technology II S1 or S2 L4T2

Chemical Property and Service Behaviour: This subject deals with the study of chemical reactions occurring between refractories and reaction products in typical industrial situations. It will provide a basis for evaluating the predicting refractory performance in the manufacture of ferrous and non-ferrous metals, glass, enamels and cements. A detailed consideration of the chemical reactions occurring between refractories and solid, liquid and vapour phases will be made. Laboratory experiments and demonstrations will form part of the course.

Candidates are expected to have a background knowledge equivalent to that expressed in the syllabus for 4.213 Chemical Ceramics (Session 1).

4.281G Chemistry of Glass Melting S1 or S2 L3T3

Pre- or co-requisites may be specified depending on student's background.

Glass structure — property relations; melting reactions and rates; refining; analytical techniques; economics of glass compositions; melting and refining agents; process chemistry; chemical durability; glass colour; glass-refractory reactions; phase transformations. Laboratory exercises.

School of Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A

SS L4T2

Prerequisite:

*HSC Exam Percentile
Range Required*

Either

2 unit Science (Physics)

31-100

or

4 unit Science (multistrand)

11-100

or

2 unit Industrial Arts

31-100

or

3 unit Industrial Arts

11-100

Statics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin jointed frames and beams. Simple states of stress. Statics of fluids.

Introduction to Engineering Design: Engineering method, problem identification, creative thinking, mathematical modelling, computer-aided design, materials and processes, communication of ideas, the place of engineering in society.

Introduction to Materials Science: For subject descriptions see under 4.001.

5.020 Engineering B

SS L/T6

Prerequisite: 5.010.

(For students in Applied Geology and Mining Engineering)

Engineering Dynamics: Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy. Kinetics of systems of particles; impulse and momentum. Rotation of rigid bodies about a fixed axis. Belt, rope and chain drives, gear trains.

and

Mechanics of Solids I: Concepts of stress, strain. Stress and deformation due to axial force. Linear and non-linear problems, compound bars. Concepts of stiffness and flexibility. Bending moment and shear force in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

5.030 Engineering C

SS L/T6

Engineering Drawing: Graphic communication first and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special

emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

and either

Introduction to Chemical Industry: For subject description see under 48.001.

or

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

or

Introduction to Mining Engineering (Compulsory for Mining Engineering students): Mineral deposits; metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases; development, exploitation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mining design and operations.

or

Introduction to Ceramic Engineering (Compulsory for Ceramic Engineering students): The classification of materials. The nature of ceramics. The materials science approach. The scope of the ceramic industry. The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials. Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, pot forming and other forming procedures.

or

Introduction to Textile Technology (Compulsory for Textile Technology students): For subject description see under 13.001.

5.111 Mechanical Engineering Design I

Prerequisite: 5.010. *Co- or prerequisites:* 5.330, 5.622, 5.422 or 8.112, 8.250.

Application of design strategy to creative design. Modelling, analysis and design of basic engineering elements and systems with further engineering drawing practice. Review of currently available mechanical technology and use of standard equipment items, codes and trade literature.

5.330 Engineering Dynamics F L/T2

Prerequisites: 1.001 or 1.011 or 1.951, 5.010 and 10.001 or 10.011.

Kinematics and kinetics of particles and rigid bodies in planar motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degrees of freedom; dynamic equilibrium, differential equations of motion; work and energy, variational principles; impulse and momentum, impact.

5.331 Dynamics of Machines I F L1½T½

Prerequisites: 5.330, 10.022.

Dynamics of Planar Mechanisms: Analytical and graphical methods for the analysis of velocities, accelerations and forces in planar mechan-

isms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing.

Mechanical Vibrations: Simple harmonic motion. One degree of freedom systems, free and forced vibrations, transmissibility and motion isolation. Whirling of shafts.

5.422 Mechanics of Solids II/Materials F L2T2½

Prerequisites: 5.010 or 5.0101, 5.421 or 5.040 or 5.020, 10.001.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Statics of frames and machines. Unsymmetrical bending. Analysis of stress; analysis of strain; generalized Hooke's Law. Thin-walled pressure vessels. Combined loads. Theories of failure. Stress concentrations and fatigue. Shear stress in beams; shear centre. Stability and buckling of columns. Solidification, Mechanical processing of metals. Phase equilibrium and its application to engineering materials. Fracture, creep, corrosion.

5.622 Fluid Mechanics/Thermodynamics F L2T2

Prerequisites: 10.001 or 10.011; 1.951 or 1.001 or 1.011, 5.010 or 5.0101.

Comprises: 5.6221, 5.6222 and 5.6223

5.6221 Introductory Thermofluids S1 L2T2

Work, energy, power. Units. Systems, states and processes. Flow fields; unsteady and compressible flow. Control mass and volume. Fluid properties, extensive, intensive. Equation of state. Tables of properties. First law of thermodynamics. Non flow processes: reversible, irreversible. Flow processes; energy equation, enthalpy, Bernoulli's equation. Momentum equations: linear and rotational. Ideal flow.

5.6222 Fluid Mechanics S2 L1T1

Flow measurement: orifice, nozzle, venturi meters, pitot tubes, other flow meters. Dimensional analysis: similitude, dimensionless numbers, methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent pressure loss, friction factor, losses in bends and fittings. Equations of fluid motion. Elementary boundary layer flow, skin friction and decay.

5.6223 Thermodynamics S2 L1T1

Ideal processes and cycles, reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps, compressors, engines. Energy equation analysis, P-V diagrams.

School of Electrical Engineering and Computer Science

Undergraduate Study

6.611 Computing I SS L3T3

Prerequisite: As for 10.001. *Co-requisite:* 10.001 or 10.011. *Excluded:* 6.600, 6.620, 6.021D.

Introduction to programming: design and correctness of algorithms and data structures; programming in a high level algorithmic language which provides simple, high level program control and data structuring facilities. Problem solving: basic ideas of problem solving; introduction to abstract structures used for computing solutions to problems. Elementary logic, history of computing, computing machinery.

6.621 Computing II S1 L3T2

Prerequisites: 6.611 (Pass Concede not acceptable), 10.001 or 10.011. *Excluded:* 6.620, 6.021D.

For those students who intend to take further subjects in computer science.

Expansion and development of material introduced in 6.611. Systematic problem development: introduction to programming language semantics, reasoning about programs, program derivation, abstract programs, realization of abstract programs (conversion from abstract to concrete). Practice in programming in a high-level programming language. Data-structures: arrays, lists, sets, trees; recursive programming. Introduction to computer organization: a simple machine architecture. Introduction to operating systems.

6.832 Industrial Electrical Machinery S2 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to the usage of electrical machinery in industry. Provides a basis of circuit-theory then considers the characteristics and selection of electrical machinery, their interface with the prime power supply, protection and electrical safety. Included is a project illustrating the application of electrical engineering to other disciplines.

6.851 Electronics and Instrumentation S1 L1T2 6.851R Electronics and Instrumentation S1 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to electronics. Provides a basis of circuit theory and elementary electronics and then treats filters, frequency response, general amplifier characteristics, operational amplifiers and their use in instrumentation, power supplies, analog computers and their use in modelling non-electrical systems. Included is a project illustrating the application of electrical engineering to other disciplines.

6.852R Electrical Machinery and Supply S2 L1T2

Prerequisite: 6.851R.

A user-oriented introduction to the usage of electrical power in industry, covering the characteristics and selection of electrical machinery, its interface with the prime power supply, protection, electrical safety and compliance with Australian standards. Included in the subject is a project illustrating the application of electrical engineering to various aspects of industry.

6.854 Electrical Engineering S2 T4

Prerequisite: 1.001 or equivalent.

Extensive introduction to the theory and application of heavy current electrical engineering. Requisite circuit theory, the distribution of electrical power and the characteristics and selection of electrical machinery. Topics include DC power supplies, three-phase AC supply, voltage regulation, transformers, AC and DC machines and their rating. Project illustrating application of electrical engineering to various aspects of industry. Two 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. Detailed lecture notes are provided.

6.855 Electrical Power Utilization S2 T4

Prerequisite: 6.851.

Introduction to the distribution and utilization of electrical power in industry. Characteristics and selection of electrical machinery, its interface with the supply, protection and electrical safety. Project illustrating application of electrical engineering to various aspects of industry. Two 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. The subject commences in week 4 of Session 2.

Graduate Study

6.380G Data Acquisition and Analysis in Remote Sensing S1 C3

Prerequisites: 10.361 or similar.

Techniques for extracting information from remotely sensed data with particular emphasis on satellite imagery. Topics taken from: nature and characteristics of earth resources and related satellites; satellite sensors and data formats; image enhancement techniques; image classification methods, including clustering, classification and feature selection; image classification methodologies; new horizons in remote sensing image analysis.

6.387G Programming and Software in Remote Sensing S2 C3

A detailed treatment of computer methods for implementing analytical techniques used with remotely sensed data. Topics include: Software requirements for image enhancement and analysis; Structure and

capabilities of the software packages LARSYS, ORSER, BICEP, LASP; Implementation of classification methodologies; Introduction to image processing hardware and associated operating systems; Interactive image processing.

6.458G Decision and Syntactic Systems for Digital Pattern Recognition

C3

Concepts and techniques in decision-theoretic pattern recognition systems with an in-depth study of both non-parametric and parametric methods. Includes: pattern, feature and classification spaces; feature selection, linear, discriminant functions and training algorithms; piecewise linear, discriminant functions; decision rules; the Bayes framework, approximation of probability densities; clustering and dimensionality reduction. Structural pattern recognition, including such topics as formal linguistics, primitives, grammar and syntax analysis as a recognition procedure.

6.467G Digital Image Processing Systems, Scene Analysis and Machine Vision

S2 C3

The fundamentals of image processing including such topics as visual perception and the image model; uniform and non-uniform sampling and quantization; image transforms; image enhancement, sharpening and smoothing; image restoration and least squares filtering; image encoding, mapping, quantizing and encoding; image segmentation and description, grammars, languages and similarity. Material oriented towards scene analysis and world models for industrial robots including scenes; labelling; shadows; shape information; structural descriptions and representing knowledge; computer vision for robots.

6.468G Computer Display Systems and Interactive Instrumentation

C3

Prerequisite: 6.060G.

Man-machine-process communication and control, and associated microprocessor based instrumentation. Review of appropriate analog and digital technology. Microcomputer hardware and programming for interactive communication using both machine and high-level languages. Display devices, operating principles and performance limitations. Hardware and software techniques for computer-generation and processing of pictures. Colour and movement. Interactive design and graphics creation. The geometry of transformations and projections. Light pens and other input devices. Non-visual communications including speech input-output.

School of Mining Engineering

Undergraduate Study

7.013 Principles of Mining

S1 L2

Mining Engineering terminology and definitions. Drilling techniques for production blasting and exploration. Explosives and rock fragmentation

processes. Mine development, access to mineral deposits and their exploitation. Surface and underground techniques. Methods of working coal and metalliferous deposits. Methods of ground support. Offshore mining; the ventilation and drainage of mines; mine transport and materials handling. Mine safety engineering.

7.023 Mineral Process Engineering

S1 L1T1

7.023R Mineral Process Engineering

F L1

The necessity for minerals beneficiation. Mineralogical assessment. Comminution: fracture, liberation, size-criteria, energy-size relationships. Crushing, grinding and attrition. Screening and classification, cyclones. Concentration processes; density, electrical, magnetic and other physical methods. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Materials balances.

7.033 Mineralogical Assessment

S1 L1

Assessment of the physical and chemical properties of economic minerals. Significance of the textures of minerals on the selection of mineral beneficiation processes. Destructive and non-destructive testing of bore cores. Factors influencing effective comminution and liberation.

7.044 Mining Economics

S1 L2T2

Aspects of micro- and macro-economics. Theory and practice of resource sampling. Valuation of mineral properties and mining projects including reserve calculation by traditional and geostatistical methods. Geological reserves and mining reserves. Interaction of grade, tonnage, mining recovery and mining method. Financing of mining ventures. Types of mining companies — private, public, no-liability. State ownership and participation. Investment decision analysis — cash flow models, sensitivity analysis. Marketing of mineral commodities.

7.111 Introduction to Mining Engineering

S1 L2

Forms part of 5.030 Engineering C.

Mineral deposits: metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mine design and operation.

7.113 Mining Methods

F L2

Prerequisite: 7.142.

Types of occurrence; stratified and non-stratified deposits. Production development for underground and surface mines. Surface mining of coal, metalliferous ores and other minerals. Offshore and marine mining. Non-entry methods. Underground coal mining: partial and total extraction systems. Pillar, shortwall and longwall mining. Special methods for thin, thick and steeply inclined seams. Simultaneous mining and multiple seams. Working seams in close proximity. Underground metalliferous mining. Underhand and overhand techniques. Classification of stoping methods: open stopes, filled stopes and caving. Secondary mining. Utilization and disposal of mine waste.

7.113R Mining Methods

F L2T1

The syllabus is as for 7.113 with the addition of the following topics. *Non-entry mining methods and petroleum engineering:* Hydrocarbon accumulation, porosity and permeability of reservoir rocks. Flow through porous media. Darcy's laws. Permeability of beds in series and parallel. Gas solubility. Reservoir energy, volumetric and radial flow calculations.

Secondary recovery. In-situ mining of sulphur, salt and potash. Underground leaching, retorting of oil shale, gasification of coal. Marine deposits, off-shore mining methods.

7.114 Geotechnical Engineering F L2T1

7.114R Geotechnical Engineering F L2

Prerequisites for 7.114: 7.123, 7.113.

Determination of in-situ rock properties. Field instrumentation. Correlation of laboratory and field data. Structural surveys. Design of underground and surface mine openings. Magnitude and distribution of stresses. Modelling techniques. Initiation and propagation of failure in rock structures. Excavation stability; natural and artificial support, permanent and temporary support. Design of support systems. Slope stability. Ground control measurements. Rockbursts. Outbursts in coal. The effects, prediction and control of mining subsidence.

7.123 Geomechanics F L1T2

7.123R Geomechanics F L1T2

Prerequisites for 7.123: 8.172, 8.250, 10.341, 10.002.

Review of stress and strain analysis. Stress tensors. Rheological models. Failure criteria. Classification systems for rocks and rock masses. Engineering properties of rocks and soils. Deformability, time, size and geometry dependent characteristics. Strength, dynamic properties, effects of pore water, permeability, bearing capacity. Strain measurement. Sampling and laboratory testing. Interpretation of data.

7.124 Coal Face Mechanisation S1 L4T2

Physical and mechanical properties of in-situ and broken coal. Coal cutting mechanics. The principles of shearing, planing, milling and trepanning applied to production and development machines. Methods of assessing the cutability of coal seams. Mechanization problems in thin, thick, steep and faulted seams. The stability, steering and control of face machines. The coal clearance sub-system. Face bunkerage. Face support systems. Packing and stowing. Manning and supervision. Materials and supplies. Performance criteria. Transferability and mobility of face equipment. Integration of production sub-systems of components.

7.132 Fluid Mechanics and Machines F L2

Prerequisites: 1.001 or 1.011 or 1.951, 5.010, 5.020, 10.001. Co- or prerequisite: 10.022.

Dimensional theory. Fluid properties. Hydrostatics. Equations of flow. Fluid flow in pipes, ducts and channels. Flow over weirs and notches. Energy balances and losses. Fluid jets. Principles of hydraulic and gas engines and associated equipment. Refrigeration and airconditioning.

7.133 Mine Transport S2 L2T½

7.133R Mine Transport S2 L2T½

Transport requirements for minerals, waste, supplies and men. Mine winding systems for shafts and drifts. The mechanics of hoisting. Mine ropes and chains. Winding cycle diagrams and calculations. Surface and underground haulage arrangements. Secondary transport systems. Rope haulage, aerial ropeways, monorails, belt conveyors, locomotive haulage. Track mounted, crawler and trackless methods. Elements of soil vehicle mechanics applied to mining equipment. Primary systems. Chain, screw and bucket conveyors and elevators. Shaker and vibratory conveyors. Hydraulic and pneumatic transport methods. Chutes and bunkers. Design of transport systems.

7.134 Metalliferous Mining Systems F L2T1

Prerequisite: 7.113.

Shaft and incline location and capacity. Disposition and dimensions of levels and main development openings. Cyclic and continuous production systems. System components and their integration. Optimum fragmentation. Ore and waste rock clearance. Location of ore passes. Flowability and degradation of ores. Draw control and loading. Pillar recovery. Preparation and placement of mine fills. Bulkhead design and dewatering of fill. Slope access and services. Crushing and storage of ores underground. Production and development scheduling. Multi-face production systems.

7.142 Mine Development F L1

7.142R Mine Development F L1

Selection of mining site. Geographic communications; transport links and services. Methods of exploratory and development boring. Provision of primary access, shaft sinking, drifts, adits and box cuts. Sinking and driving through water-bearing and unconsolidated ground. Temporary and permanent methods of supporting mine entries. The provision of shaft-bottom, inset and sub-level installations. Surface requirements for winding, hoisting, ventilation and drainage. Surface layout. Engineering, administration and welfare facilities. Environmental considerations, surface structures, spoil and effluent disposal. Land restoration, mining community requirements.

7.143 Mine Environment and Safety Engineering F L2T1½

7.143R Mine Environment and Safety Engineering F L2T½

Prerequisites for 7.143: 7.132, 7.142.

Natural and artificial ventilation. Air requirements. The design and analysis of ventilation networks. The characteristics, operation and installation of mine fans. Auxiliary ventilation systems. Psychrometry. Heat and humidity control in deep mines. Mine gases. Liquid and metallic poisons, their origins, detection, monitoring and control. Airborne dust sources and suppression. Physiological effects of vitiated and contaminated air. Spontaneous combustion, fires, explosions and inundations. Rescue and recovery. Mine water control and drainage. Pumping installations. Noise measurement and control. Illumination requirements. Design of mine lighting installations. Laws relating to safety and health. Study of accidents and methods of improving safety.

7.144 Surface and Offshore Mining S2 L4T2

Opencast mining of coal and bedded deposits. Open pit mining for irregular and inclined deposits. Quarrying. Scale of operations, stripping ratio. Overburden removal, special blasting methods. Shovel, dragline and excavator calculations. Loading and haulage. Ground stability considerations, slopes, inclines and spoil heaps. Bench geometry. Haulage roads and tracks. Groundwater control. Climatic effects. Site restoration. Stream and offshore dredging for metals, minerals, gemstones and construction materials. Evaluation of marine deposits. Dredge design and operation. Beach sand mining. Deep sea mining. International agreements and law.

7.153 Power Supply in Mines S1 L2T½

7.153R Power Supply in Mines S1 L2T½

Prerequisites for 7.153: 6.851, 7.132.

Electrical power generation, distribution and control. Transformers and rectifiers. Motor characteristics. Starting and switching. Mine cables.

Flame proofing and intrinsic safety. Signalling and communications. Compressed air: generation, distribution, applications and equipment. Compressors and receivers. Oil hydraulic power. Fluid characteristics. Emulsions, inverts and non-flammable oils. Components and circuits. Pumps, motors, valves. Speed and torque control.

7.154 Petroleum Engineering F L2T1

Properties of liquid and gaseous petroleum. Exploration techniques. Elements of reservoir engineering. Drilling rigs. Cable tool, rotary and down the hole drilling. Bit design. Other drilling methods. Drilling fluids and muds. Directional drilling. Coring, core-analysis and logging. Well cementing and casing. Suction rod pumping. Well simulation.

7.163 Excavation Engineering F L1T1

7.163R Excavation Engineering F L1T½

Rock drilling and boring. Percussive, rotary, hybrid and exotic methods. Drilling patterns for shafts, headings, faces and benches. Classification of chemical explosives and their application. Detonation. Misfire procedures. Alternative explosive agents. Special blasting techniques including presplitting, profiling, trenching, casting and demolition. Environmental considerations, handling and storage of explosives, vibrations. Nuclear blasting. Rock fragmentation by machine. Principles of rock cutting mechanics. Drag picks and free rolling cutters. Hydraulic mining. Water jet cutting. Thermal, electrical, ballistic and other novel fragmentation techniques. Rock cutting tool materials. Effect of tool metallurgy on wear and fracture resistance. Methods of assessing rock cutability. The design of cutting arrays for machine mining.

7.164 Tunnel Engineering F L2T1

Scope for tunnels. Site investigation. Primary excavation in soft and hard ground. Drilling and blasting. Tunnelling shields, full face boring, partial face machines. Hybrid systems. Debris disposal. Temporary and permanent support. Ground stability. Sub-aqueous tunnels. Cut and cover tunnels. Immersed tubes. Compressed air working. Environmental considerations. Tunnel services, ventilation, drainage and lighting for road and all-rail tunnels.

7.173 Computer Applications in Mining F L1T1

Prerequisite: 10.022.

FORTAN programming. Simulation of mining problems. Application of selected programs to mining exploration, operations, economics and design.

7.174 Mining Legislation FL1

An appreciation of the laws relating to mining practice and to safety and health in mines.

7.193R Mine Technology F T4

A program of tutorials and laboratory work as the alternative to concurrent industrial experience. The student is given reading and technical assignments to complement the study of third year subjects in a full-time course.

7.194R Mine Design Practice F T5

The student is given exercises in the application of mine equipment, and in safety and environmental precautions, to complement the lecture materials in third and fourth years of a full-time course. This is the alternative to concurrent industrial experience.

7.213 Mine Surveying S1 L1T1

7.213R Mine Surveying FL1

Prerequisites for 7.213: 10.341 and 29.441

Surveying methods applied to the development and extraction of minerals. Instruments of special value in mine surveying. Correlation of underground and surface surveys. Progress measurement. Determination of reserves. The surveying and logging of boreholes. Preparation of mine plans.

7.214 Mine Economics and Planning F L2T2

7.214R Mine Economics and Planning F L2T1

Prerequisite for 7.214: 7.113.

Aspects of micro- and macro-economics. Theory and practice of resource sampling. Valuation of mineral properties and mining projects. Investment decision analysis, cash flow models. Sensitivity analysis. Marketing of minerals. Type of companies, private, public, no-liability, state ownership and participation. Financing of mining ventures. Contracts and project assessment. Selection procedures for systems and equipment. Obsolescence and replacement. Maintenance planning. Manpower planning, standards of performance, control of projects and technical reporting.

7.224 Operational Management F L1T1

7.224R Operational Management F L1T½

Elementary industrial psychology. Work measurement. Design of jobs and work methods. Incentive and remuneration. Trade Unions. Communications and consultation. Disputes, conciliation and arbitration. Recruitment, selection and training of operators and supervisors. Mine management structure and organization. Management of change. Operations research: control networks, decision analysis, linear programming, queueing theory, simulation, improvisation. Management accounting and budget control. Grade control, estimation of cut-off grades. Purchasing and stores policies. Statutory responsibilities of management and mine officials.

7.234 Mineral Economics F L1

Business cycles. Theory of wages. Types of mine contracts. London metal exchange. The economics of processing after the mine lease. National stockpiles. Depletion of world resources. Prediction techniques for supply and demand. Type of company, statutory duties of directors.

7.313 Minerals Engineering Processes F L1T2

Prerequisites: 25.520 or 25.201, 5.030.

Beneficiation requirements. Scope of mineral processing. Sampling and mineralogical assessment. Comminution, fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and

classifying. Fluid dynamics of suspensions. Attrition. Concentration processes: density, electrical, magnetic and other physical methods. Cyanidation, amalgamation, leaching, solvent extraction and ion exchange. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Drying. Materials balances.

7.313R Mineral Processing **F L2T3**

A combination of 7.313, with selected topics from 4.374.

7.314 Mineral Process Technology **F L2T1** **7.314R Mineral Process Technology** **F L2T1**

Prerequisite: 7.313 or 7.313R.

Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analysis and measurements. Laboratory and pilot plant testing. Flowsheet design. Equipment selection. Plant layout. Monitoring and control systems. Process evaluation. Storage and blending. Materials handling. Waste disposal and pollution control. Waste treatment. Process simulation. Marketing.

7.414 Minerals Industry Project **F L1**

Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of School. The work may take the form of an engineering analysis, experimental investigation, theoretical study or design project. Candidates may be required to present themselves for oral examination on the subject of their submission.

7.414R Minerals Industry Project **S1 S2 T4**

Periods are set aside each week to provide time for the students to consult library references, prepare notes and undertake experimental work. The project supervisor is available for discussion at agreed times but the student is expected to work on his or her own initiative. The only examination is by assessment of a submitted written thesis, which must consist of two parts: a literature survey and a report on research.

The thesis is to be based on a modest, but significant, research project, which may be on some aspects of a staff member's or mine company research interests. Most projects are experimental in nature but some may be largely theoretical.

7.416R Minerals Industry Project **F T2**

A shorter version of 7.414R above.

7.424 Industrial and Research Seminars **F L1**

The program includes two types of seminar. One deals with research work being undertaken or recently completed by members of the School of Mining Engineering. The other involves engineers and scientists from industry, other University Schools and research establishments discussing projects of special or topical interest in mining and allied fields.

7.424R Feasibility Studies and Seminars **F T2**

Group work on the creation of a mining complex from an original mineral deposit with its approximate costing. Appraisal of the result as an

investment. The work draws on all other courses and consists mainly of tutorials and seminars by students, and by visiting lecturers. Students are expected to present written technical reports and memoranda for assessment.

Graduate Study

Generally the subjects are of three hours' duration per week or multiples of that time.

7.001G Exploratory Drilling and Development

Drilling equipment and technology. Deep boring. Selection of drilling methods: drill hole surveys. Development and exploitation of mineral resources. Exercises on mine planning.

7.111G Mining Engineering

1. Surveying methods to quantify mineral resources. Mine development. Explosives. Shaft sinking, tunnelling, excavation methods. 2. Advanced mining systems, parameters for applicability and efficiency of mining methods, waste disposal. Non-entry methods, in situ mining. Off-shore mining methods. Rock mechanics, mechanical behaviour of rocks. The Mining Acts.

7.122G Mining Engineering Technology

1. Mine ventilation, contaminants, toxicity of mineral particles and gases, thermodynamics of mine air, network analyses, air conditioning in mines. Mine safety, health, hygiene, noise. 2. Mine lighting, electrical power distribution, generation and reticulation of compressed air. Materials handling. Surface and underground haulage systems, design criteria. Mine drainage. Standards specifications. 3. Feasibility studies. Mine design and layout, separation of functions for maximum efficiency; application of analogue and digital computers. Production control, grade control, administration. Resources allocation, finance, labour, equipment. Size and scope of mining company operations. 4. Mine support. Mining methods employing fill, fill compressibility. Rock and cemented rock fill. Placement of mixed fills. 5. Rock mechanics. Stress and strain analysis. The mechanics of strata movement and the distribution of pressure around mine workings. Ground control and methods of support in the workings and the waste. Design of mining excavations. Slope stability. 6. Subsidence phenomena associated with mine workings. Methods of working and design of structures to minimize damage.

7.132G Mining Engineering Laboratory

A selection of advanced laboratory investigations in sampling and valuation, mine support, temporary or long term; mine design and plant related to extraction and servicing functions; rock properties; programming of mining methods and transport; non-entry mining; petroleum engineering; gasification; solvent processes.

7.151G Ground Control and Excavation Engineering

1. Natural state of stress in rock masses. Effects of geological structures on the stability of mine working. Stresses and rock movements induced

by mining operations. Design of mining systems and layout of workings based upon rock mechanics and functional considerations. **2.** Principles and design of support systems. Inter-relation of temporary, stabilizing and long term support. Support of permanent mining and civil engineering openings. Control of ground in the vicinity of production excavations. **3.** Design and construction aspects of open pit slopes and tailing dams. **4.** Rock-breaking and drilling methods; penetrability workability of rocks; fracturing. Nature, occurrence and prediction of rockbursts. Mechanics of crack propagation and subsidence.

7.152G Mining Conservation

The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts, land clearing, stabilizing the mined area, socio-economic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

7.153G Environmental Conditions in Mines

The energy equation applied to ventilation, sources of heat in mines, geothermal gradients, thermodynamics, pressure-volume diagrams. Practical aspects of high air temperatures and the control of atmospheric conditions in deep underground mines. Fan design, installation and testing. Psychrometry, ventilation planning. Computer applications. Selected laboratory experiments and network designs.

7.154G Rock Excavation and Transportation

Rock fragmentation drilling, blasting large rounds. Loading techniques, shovels, draglines, bucket wheel excavators, dredges, front-end loaders, tractor scrapers. Operating factors, selection procedures, cost estimating. Materials handling, continuous, semi-continuous, batch systems, cost analysis.

7.311G Mineral Beneficiation

Prerequisite: 7.023.

Processing economics: mineral processing and its integration with mining, metallurgical and chemical operations. Principles of roasting, leaching, electrolysis, cementation, solvent extraction and ion exchange. Particle mechanics size, shape, surface area, size distribution functions. Relative and bulk densities. Theory of fracture mechanisms, comminution, energy requirements. Processes of agglomeration. Physical separation methods, electronic sorting, electrostatic and magnetic separation.

7.322G Mineral Beneficiation Technology

Prerequisite: 7.311G.

1. Fluid mechanics of mineral pulps, free, hindered and zone settling, thickening, classification, hydrocyclones, dewatering, filtration. Gravity concentration, jigging, sink and float, flowing film, fluidized beds. **2.** Interfacial phenomena, the structure of solid-water, air-water, solid-air

and oil-water interfaces. Experimental techniques applicable to the study of these interfaces. Electrokinetic theory, electrical double layer interaction. Adsorption mechanisms. Collectors, activators, depressants, modifiers, frothers, flocculants. **3.** Sulphide mineral flotation, xanthate chemistry, oxide mineral flotation, salt mineral flotation. Coal preparation, coal constitution, bore core evaluation, selective preparation, blending for utilization. **4.** Process design. Feasibility studies, extraction processes and environmental conditions. Selection and location of equipment, fluid-solids flow, design of auxiliary units, development and presentation of flow-sheets. Sampling and experimental techniques, batch, continuous and pilot plant testing. Scale up. Product disposal. Principles of chemical analysis, instrumentation, measurement of variables in mineral processing, controllers, use of computers. Technical management.

7.332G Mineral Engineering Laboratory

Prerequisite: 7.311G.

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

7.351G Mineral Beneficiation

Prerequisite: 7.313 or 7.311G.

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

7.361G Minerals Engineering I

S1 L3 T4

1. Principles of mineral deposition. Constitution of coal. Fuel technology. Coke making. Principles of extractive metallurgy. Beneficiation and utilization of industrial minerals. Materials balances. **2.** Fluid dynamics of mineral pulps. Rheology of fluids and particulate suspensions. Dynamics of particle and bubble motion and collision. Flow through porous media. Fluidized beds. Flow in pipes, open channels and thin films. **3.** Materials handling: Flow characteristics of granular materials. Belt and mechanical conveyors. Stockpiles, bins and hoppers. Blending. Feeders. Distributors. Slurry pumps. Solids pipelines. Sampling theory and practice. **4.** Particle statistics: Concepts of particle size. Size analysis methods. Size distribution functions. Specific surface. Shape factors. Number-, Surface- and Volume mean sizes. **5.** Interfacial phenomena: Free surface energy. Surface tension. Three phase contact. Electrokinetic theory. Double layer interaction. Chemical and physical adsorption. Experimental techniques. Foams.

7.362G Minerals Engineering II

S1 L4 T4

1. Comminution: Fracture. Liberation. Energy-size relationships. Grindability. Conventional comminution equipment. Feed and product characteristics. Open and closed circuit operation. Vibratory and fluid energy mills. **2.** Screening and classification: Screening as a process of chance. Screen loading. Factors affecting screen capacities. Types of screen. Probability screens. Optical imaging. Hydraulic, mechanical and

cyclone classifiers. **3.** Physical concentration processes: Gravity concentration. Jigs, heavy media and flowing films. Electronic and optical sorting. Electrical and magnetic separators. **4.** Chemical concentration processes: Leaching. Solvent extraction and ion exchange. Cementation. Cyanidation and amalgamation. **5.** Flotation: Collectors, activators, depressants, modifiers, frothers. Conventional and novel cells. Flotation kinetics. Entrainment. Soluble salt flotation. Reverse flotation. Agglomeration and carrier flotation. Selective flocculation and agglomeration. **6.** Liquid-solid separation and product disposal: Flocculation. Thickening. Filtration. Drainage. Dewatering by screens and cyclones. Centrifuging. Dryers. Tailings dams. Tailing utilization including mine fill, reclamation. Pollution control.

7.363G Minerals Engineering Laboratory S1 L3

A series of laboratory investigations relating to material covered in subjects 7.361G and 7.362G.

7.364G Minerals Engineering III S2 L4 T4

1. Process analysis and simulation: partition and efficiency curves. Washability curves. The Mayer curve. Computer models of comminution, sizing and concentration processes. Laboratory and pilot scale testing. Scale up procedures. **2.** Process design: Process appraisal, selection of technology based upon mineral properties, extraction processes, energy requirements and environmental conditions. Feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Process flowsheet planning, equipment selection and details of solid and fluid flows. Engineering flowsheets showing details of major and auxiliary units, materials handling, product disposal, water and electricity distribution and equipment control. **3.** Instrumentation and Control: Principles of chemical analysis. Laboratory and *in situ* instrumental analysis. Flow and density gauges. Level detectors. Belt weighers. Controllers and control strategies. Automation. **4.** Plant design: Factors influencing selection of site. Plant and site layout. Preparation of technical and commercial specifications and tender documents. Construction scheduling. Environmental aspects. Noise control. Safety. **5.** Management: Personnel selection and training. Trade Union organization. Communications and consultation. Management structure and organization. Marketing. Contracts and smelter schedules. Maintenance planning. Accounting and budget control. Purchasing and stores policies.

7.365G Minerals Engineering Project S2 T10

Laboratory work to evaluate information necessary for the design of a process for the beneficiation of ore from a metalliferous deposit, preparation of coal or treatment of industrial minerals. Candidate's report to include a process flowsheet, an equipment and materials flowsheet and a plant design layout.

7.442G Mineral Industry Analysis S2 L2

Aspects of micro- and macro-economics. Type of companies, private, public, nonliability, State ownership and participation. Financing of mining ventures. Contracts and project assessment. Obsolescence and replacement. Operations research control networks, decision analysis, linear programming, queueing theory, simulation, improvisation. Grade control, estimation of cut-off grades. Includes advanced work in the technical and economic analysis of mining or mineral operators. Cases are selected for examination and analysis; critical review.

School of Civil Engineering

Undergraduate Study

8.021 Environmental Aspects of Civil Engineering

SS L2T1

Prerequisite: 8.301, or equivalent.

Examination of the professional issues arising from the environmental impact of civil engineering planning, design and construction. Methodologies for environmental impact evaluation and general project evaluation. Environmental legislation, institutional procedures and decision-making processes. Case studies and project work.

8.112 Structures

S1 L1T2

Theory of Structures: Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strains. Relationship between load, shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment, shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

8.171 Mechanics of Solids I

SS L1½T1½

Prerequisite: 8.170.

Applications of laws of static equilibrium to structures. Concepts of stress, strain. Equilibrium, compatibility and stress-strain relationships. Stress and deformation due to axial force; linear and non-linear problems; compound bars. Concepts of stiffness and flexibility. Bending moments and shear forces in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

8.172 Mechanics of Solids II

SS L2T2

Prerequisite: 8.171.

Structural statics. Bending moments, shear force and torsion. Stresses due to shear force in solid and thin-walled sections; shear centre. Torsion of circular, non-circular and thin-walled sections. Principal stresses and strains; yield criteria. Combined stresses. Concepts of instability.

8.250 Properties of Materials

F L1T1

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact. Deterioration of engineering materials. Rheological classification of materials.

Graduate Study

8.402G Transport, Environment, Community F C6

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity: government, bureaucracy and public involvement in transport policy and environment impact statements.

8.403G Theory of Land Use/ Transport Interaction C3

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state (functional, behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium- long-term; action planning, strategic planning; local, urban, regional, national).

8.413G Transport Economics C3

Cost and price analysis of each of the transport modes (road, rail, air and sea). Welfare analysis and taxation theory with respect to transport. Economics of location; economics of land use models; regional trade model.

8.701G Economic Decision Making in Civil Engineering C3

Review of practical engineering decision-making problems and relevant techniques. Engineering economics, benefit/cost analysis, consideration of inflation and taxation in investment decisions, bidding, decision theory, microeconomic theory, objectives and criteria, multiple objective planning.

8.703G Optimization Techniques in Civil Engineering C3

Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.753G Soil Engineering C3

Soil pedology, fabric studies. Soil stabilization with cement, lime, bitumen and others. Grouting. Special techniques of piling. Soil anchors, slurry trench design. Freezing and thermal soil treatments. Vacuum and electro osmotic dewatering. Advanced techniques for the in site measurement of soil properties. Variability of safety factors.

8.820G Structural Analysis and Finite Elements I (SAFE 1) C3

Stiffness analysis of structures. Basis of Finite Elements. Principle of Virtual Work, variational theorems, constraint equations. Effects of inplane rigid floors and axially rigid members on the behaviour of multi-storey frames.

8.833G Free Surface Flow C3

Theory of water flow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

8.837G Hydrological Processes C3

Hydrologic cycle, water and energy balances, atmospheric moisture, precipitation process, evaporation and transpiration, storm runoff process, land use and management, stream gauging, instruments.

8.838G Flood Design C3

Excluded: 8.846G.

Introduction to flood estimation, design rainfall data, hydrograph analysis, storm runoff, loss rates, rational method, unit hydrographs, introduction to urban drainage design, flood frequency.

8.839G Advanced Flood Estimation C3

Flood routing, catchment characteristics, runoff routing, synthetic unit hydrographs, urban runoff, regional empirical flood estimation methods, advanced unit hydrograph theory.

8.842G Groundwater Hydrology C3

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

8.843G Groundwater Hydraulics C3

Mechanics of flow in saturated porous materials, steady and unsteady flow to wells, leaky aquifers, partial penetration, multiple aquifer boundaries, delayed yield from storage, regional studies.

8.847G Water Resources Policy C3

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

8.848G Water Resource System Design C3

Principles of the optimal design and operation of multiple purpose, multiple component, water resource systems; evaluation of cost and benefits in complex and simple systems.

8.849G Irrigation C3

Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement; irrigation efficiency. Design of irrigation systems, appurtenant works, distribution.

8.850G Drainage of Agricultural Land**C3**

Characteristics of drainage systems, steady and unsteady state drainage formulae, conformed transformation solutions, soil characteristics, field measurement of hydraulic conductivity and soil water pressure, significance of unsaturated zone, practical aspects.

8.860G Investigation of Groundwater Resources I**C3**

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources II**C3**

Geophysical methods, remote sensing, photointerpretation, arid-environment studies, analog models, case studies.

8.864G Arid Zone Hydrology**S1 L1½T1½ C3**

Co-requisites: 8.837G. 8.838G.

Arid zone rainfall characteristics; data collection and instrumentation; runoff processes; infiltration, transmission loss; recharge processes; flood characteristics and design; water yield; storage of water; evaporation and evaporation suppression; sediment transport and measurements.

8.865G Arid Zone Water Resources Management**S1 or S2 L1½T1½ C3**

Water as a resource: demand for and supply of water; works and management to match demand with supply. Special features of the arid zone: climate; water uses, quantification of demand quantities and qualities, arid zone grazing system modelling; water supplies, quantities and qualities; measurement of flow rate, volume, quality. Engineering works: design, construction, operation and maintenance of works, including excavated tanks, dams, pipelines, pumps, windmills, engines and motors, troughs; costs; reliability; energy sources for pumping. Special practices: water spreading, irrigation including trickle irrigation; evaporation reduction, desalination.

8.909G Project**S2T9* C9**

A minor research investigation involving analysis and interpretation of data, or a critical review and interpretation of literature on a selected topic, or a design project. Entails the equivalent of 12 weeks of full-time study under minimal supervision.

8.918G Research Project**FT9* C18**

As for 8.909G but involving more substantial research entailing the equivalent of six months of full-time study.

School of Wool and Pastoral Sciences

Undergraduate Study**9.001 Project****F T6**

Students are required to conduct an experimental or theoretical investigation under supervision and to submit a thesis describing the results of their investigations. Throughout the year students are required to submit progress reports to their supervisors and to present seminars. The written reports of the project shall be submitted by the last day of Session 2.

9.002 Seminar**F T1**

Seminars deal with research and/or development work being undertaken or recently completed by members of the School of Wool and Pastoral Sciences, other University schools and research organisations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries.

9.101 Biology of Grazing Sheep and Cattle**S1 L2T4**

Introduces the principles of Wool and Pastoral Sciences. Covers the sheep and cattle industries and wool and meat as end products of these industries; production and use of pasture, nutrition of grazing ruminants; reproduction in sheep and cattle; climate and animal production; and introduction concepts of animal health.

Field excursions and laboratory work are integral parts of the course.

9.111 Livestock Production I**F L2T1**

Prerequisite: 9.101.

The sheep and beef cattle industries and their place in the economic life of Australia; levels of production and trends. The physical, biological, managerial and economic conditions influencing production. Sheep producing zones. Sheep breeds for wool production. Cross-breeding, prime lamb production. Sheep and cattle management; nutrition, reproduction, survival.

A field excursion of one week's duration is held in session 1.

9.112 Livestock Production II**S1 L2T1**

Prerequisite: 9.111.

The scope for intensification of ruminant production. The behaviour, nutrition, environmental physiology and health of intensively managed animals. Housing and environmental control of facilities. Examples of intensification, eg feed lots, sea transport.

9.113 Livestock Production III**F L1T2**

Principles of livestock production applied to reproduction and fertility; growth and development. The meat industry. Carcass conformation and composition. Pre and post mortem factors affecting meat quality. Meat marketing.

*Equivalent contact hours, but also including fieldwork out of session.

9.131 Animal Health**S2 L2T1***Prerequisite:* 9.111.

Managerial prevention and control of grazing livestock health, the animal species involved, the concept of economic approach to animal health. Introductory immunology. Skin health; sheep and cattle. Control of external parasites, particularly by insecticides. Reproductive health; sheep and cattle. Internal parasites; flukes, cysticercosis and tape-worms, nematodes. Legal and Public Health responsibilities; Acts of Parliament relating to animal health.

9.132 Animal Health**S1 L2T1***Prerequisite:* 9.131.

Use and misuse of products used in animal health work. Internal parasitism. External parasitism. Feedlot health. Transport health. Problems causing disease and death. Health of horses and dogs used in livestock management.

9.201 Agronomy**F L2T2***Prerequisite:* 9.101.

Agricultural climatology, soil science, and soil conservation. Pastures in land use and land development. Principles of tillage, crop rotation, irrigation, conservation of fodder and fertilizer usage. Weeds and weed control. Practical work in the systematics of selected plant families.

9.202 Pastoral Agronomy**F L2T1***Prerequisite:* 9.201.

Pasture ecology. Establishment, management and utilization of pastures and fodder crops. Pasture-animal relationships, stocking rates, mixed stocking. Vegetation management in arid and semi-arid areas. Pasture evaluation and pasture research techniques.

9.203 Crop Agronomy**S2 L2T1***Prerequisite:* 9.201.

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

9.204 Range Management**S2 L1T2***Co- or Prerequisite:* 9.202.

Basic range ecology and rangeland ecosystems. Plant physiology — growth and development of rangeland plants. Rangeland management practices. Monitoring of long-term trends in productivity. Applications of remote sensing and ground truth sampling. Wild life resources and feral animals and their management. Sheep and beef cattle production in arid and semi-arid environments. Administration of rangelands (eg, the functions of the Western Lands Commission, the National Parks and Wildlife Service, and the Soil Conservation Service in New South Wales).

Involves one week of instruction at Fowlers Gap Research Station.

9.301 Agricultural Economics and Management I**S1 L2 S2 L2T2**

The subject covers two broad strands: basic economic principles, and applied methods for farm management planning. The material on

economic principles centres on (a) the theory of production economics, which provides the background for many of the tools of applied farm management; and (b) price theory with emphasis on agricultural markets.

The management planning strand emphasises basic farm planning procedures such as partial, whole-farm and parametric budgeting, and gross margins analysis. As necessary background for the application of such methods, the course also includes coverage of valuation principles, land tenure, systems of title, discounting procedures, depreciation methods, tax and credit structures, and discussion of the design and use of farm record systems.

9.302 Agricultural Economics and Management II**F L2T1***Prerequisite:* 9.301.

Analysis of agricultural policies: agricultural marketing concepts; and an introduction to international trade theory. Investment appraisal and cost-benefit analysis.

Quantitative methods in agricultural economics and farm management with emphasis on — (i) Response surface estimation and analysis. (ii) Linear programming methods, with an introduction to other mathematical programming methods. (iii) Systems analysis and simulation methods.

9.412 Agricultural Chemistry II**F L2T4***Prerequisite:* 2.003J.

Proximate analysis of feeding stuffs, calorimetry, further work on fats, carbohydrates and proteins. Autoxidation and relationship to loss of animal nutritional factors. Antioxidants, natural and synthetic; correlations of *in vitro* and *in vivo* action to tocopherols and organo-sulphur and selenium compounds. Protein homogeneity, enzyme separation and assay. Sulphur reactions of proteins; thiolation and grafting. Free radical and ionic reactions of disulphides. Sulphydryl-disulphide interchange and displacement reactions. Partial oxidations.

Animal milks, analysis and heat treatment changes and detection. Roles of trace metals in biological processes, metal complexes with proteins and metal catalysis.

Anthelmintics; oxidation products and possible origin. Fungicides and herbicides, formulation and survey of commercial materials. Analysis and trace residue detection. Vitamins, enzymes and hormones. Photochemistry, energy transducers. Isotope techniques.

9.421 Animal Nutrition**S2 L3T1**

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 is given to nutritional requirements of sheep, those of other farm livestock are dealt with in this section.

9.501 Wool Science I**F L4T3***Prerequisite:* 9.101.

Raw materials and fibre identification; yarn manufacture; fabric manufacture; dyeing and finishing; testing and quality control. Wool biology; wool growth; wool fibre properties. Physical fleece characteristics; clip preparation; fleece defects; wool marketing procedures.

9.502 Wool Science II**F L1T2***Prerequisite:* 9.501.

The effect of clip preparation on textile processing; wool metrology (raw wool); distribution of fibre parameters.

9.503 Wool Science III**F L2T2***Co- or prerequisite:* 9.502.

Evaluation and typing; organizational structure of the wool industry.

Marketing schemes: commercial (reserve price; AWC marketing plan); technical (traditional, sale by sample, sale by separation, sale by description).

Wool metrology; advanced appraisal and evaluation; current wool outlook; research developments.

9.601 Animal Physiology I**S2 L3T3***Prerequisite:* 17.021.

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**F L2T2***Prerequisite:* 9.601.

Neuroendocrinology and reproductive physiology. Physiology of lactation and growth. Physiology of digestion. Environmental physiology. Water and electrolytes. The application of physiology in research.

9.801 Genetics I**S1 L2 S2 L2T1***Prerequisite:* 9.111.

Applied genetics in relation to sheep and other farm livestock. Mendelian inheritance. Chromosomes, linkage and the physical basis of heredity. Gene action in physiology, development and sex determination. Mutation. Principles of statistical genetics, strength of inheritance, selection, interrelationships, genetics and livestock improvement.

9.802 Genetics II**F L2T2***Prerequisite:* 9.801.

Genetic structure of populations. Forces causing genetic change. Partition of genetic and phenotypic variation. Resemblance between relatives and estimation of genetic parameters. Direct and correlated

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 of selective progress.

9.811 Biostatistics I**S1 L2T2***Prerequisite:* 45.101.

Experimental design to reduce experimental error. Factorial experiments. Fixed, mixed and random models. Response surface methods. Fractional replication. Confounding. Elements of multivariate analysis.

9.812 Biostatistics II**S2 L2T2***Prerequisite:* 9.811.

Least squares methods. Application to multiple regression. Application to experimental design models. Analysis of non-orthogonal data. Analysis of covariance. Non-linear regression.

9.901 Rural Extension**F L2T2**

Development of communication skills through experiential or active learning situations. Educational, psychological and sociological factors relating to the diffusion of innovations. Program planning and evaluation.

Graduate Study**9.105G Livestock Production****F L2 T4**

Biology of reproduction and reproductive performance of sheep and cattle; growth and body composition; meat production and quality.

9.205G Range Management**F L1 T3**

Objectives in the utilization and management of rangelands. Ecology of rangelands, with emphasis on the impact of grazing. Degradation of rangelands. Morphology and physiology of range plants in relation to management. Grazing management. Burning as a management practice. Assessment of range condition and trend. Applications of remote sensing. Sheep and cattle production in arid and semi-arid environments. Native and feral animals and their management. Diet selection of different species. Administration of rangelands. Assignment work and field studies, including a week at Fowlers Gap Arid Zone Research Station.

9.424G Minerals and Their Effects on Grazing Animals**C2**

The importance of minerals for mammals. The nutritional significance of the important elements and the effect of ingestion, inhalation, or absorption of excessive amounts of these elements will be discussed. Emphasis on grazing sheep and cattle, but with other examples where appropriate.

9.504G Wool Science**F L2 T4**

Biology and histology of fibre growth and fibre structure. Wool physics and chemistry. Objective characteristics of the Australian wool clip. Preparation for sale, measurement, specification, valuation and marketing of wool. Wool metrology and conditioning house procedures. Fibre parameters in processing.

9.803G Animal Breeding**F L2 T2**

Co-requisite: 9.802.

Definition of breeding objectives; case studies of production recording and breed improvement programs for sheep and beef cattle. Development of performance recording systems: choice of traits to be recorded, recording and processing methods. Estimation of breeding value from performance records. Breed evaluation. Optimal design for breeding programs. The impact on genetic improvement of techniques for controlling reproduction.

9.813G Quantitative Methods**F L2 T2**

Selected topics in: biostatistics and economic statistics, with emphasis on experimental design and on least squares procedures; response surface estimation and analysis; mathematical programming methods for rural industries; data processing and computer programming; systems analysis and simulation methods.

10.011 Higher Mathematics I**F L4T2**

Prerequisites:

*HSC Exam Percentile
Range Required
71-100*

3 unit Mathematics

or

4 unit Mathematics

11-100

*Excluded**:* 10.001, 10.021A, 10.021B, 10.021C.

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

10.021A General Mathematics IA***S1 L4T2**

Number systems (including absolute value, inequalities, surds, etc.); co-ordinate geometry; polynomials, quadratics; concepts of the function; trigonometric functions, logarithmic and indicial functions and their laws of operation; introduction to differentiation and integration with simple applications.

10.021B General Mathematics IB**S1 or S2 L4T2**

Prerequisites:

*HSC Exam Percentile
Range Required
51-100*

2 unit Mathematics

or

3 unit Mathematics

or

4 unit Mathematics

or

10.021A

1-100

*Excluded**:* 10.001, 10.011.

Functions (and their inverses), limits, asymptotes, continuity; differentiation and applications; integration, the definite integral and applications; inverse trigonometric functions; the logarithmic and exponential functions and applications; sequences and series; mathematical induction; the Binomial Theorem and applications; introduction to probability theory; introduction to 3-dimensional geometry; introduction to linear algebra.

10.021C General Mathematics IC**S2 L4T2**

Prerequisite: 10.021B. *Excluded**:* 10.001, 10.011, 10.021A.

Techniques for integration, improper integrals; Taylor's Theorem; first order differential equations and applications; introduction to multivariable calculus; conics; finite sets; probability; vectors, matrices and linear equations.

10.022 Engineering Mathematics II**F L2T2**

Prerequisite: 10.001.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

*If a unit in this list is counted the unit above may not be counted.

School of Mathematics

Undergraduate Study

10.001 Mathematics I**F L4T2**

Prerequisites:

*HSC Exam Percentile
Range Required
71-100*

2 unit Mathematics

or

3 unit Mathematics

or

4 unit Mathematics

or

10.021B

21-100

1-100

*Excluded**:* 10.011, 10.021A, 10.021B, 10.021C.

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

10.031 Mathematics† F L1T1

Prerequisite: 10.001 or 10.021C (CR).

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; multiple integrals, matrices and their application to theory of linear equations, eigenvalues, introduction to numerical methods.

10.032 Mathematics† F L1T1

Prerequisite: 10.031.

Vector calculus; special functions; convolution theorem and applications, complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

10.111A Pure Mathematics II — Linear Algebra F L1½T1

Prerequisite: 10.001. *Excluded:* 10.121A.

Vector spaces, linear transformations and matrices, change of basis. Eigenvalues and eigenvectors, generalised eigenvectors. Functions of matrices. Linear systems of differential equations including the use of Laplace transform. Inner products, orthogonalization, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1113 Pure Mathematics II — Multivariable Calculus S1 or S2 L1½T1

Prerequisites: 10.001. *Excluded:* 10.1213.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.1114 Pure Mathematics II — Complex Analysis S1 or S2 L1½T1

Prerequisite: 10.001. *Excluded:* 10.1214.

Analytic functions, Taylor and Laurent series, integrals. Cauchy's Theorem, residues, evaluation of certain real integrals.

10.121A Higher Pure Mathematics II — Algebra F L2T½

Prerequisite: 10.011 or 10.001 (DN). *Excluded:* 10.111A, 10.1111.

Linear Algebra: vector spaces, commutative rings, polynomials, modules, linear transformations, eigenvectors, invariant subspaces, canonical forms, linear functions, bilinear and multi-linear algebra. Group Theory: sub-groups, quotient groups, isomorphisms, Lagrange's theorem, Sylow's theorem.

10.1213 Higher Pure Mathematics II — Multivariable Calculus S1 L2T½

Prerequisite: 10.011 or 10.001 (DN). *Excluded:* 10.1113.

As for 10.1113 but in greater depth.

10.1214 Higher Pure Mathematics II — Complex Analysis S2 L2T½

Prerequisite: 10.1213. *Excluded:* 10.1114.

As for 10.1114 but in greater depth.

10.2111 Applied Mathematics II — Vector Calculus S1 or S2 L1½T1

Prerequisite: 10.001. *Excluded:* 10.2211, 4.813.

Vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics II — Mathematical Methods for Differential Equations S1 or S2 L1½T1

Prerequisite: 10.001. *Excluded:* 10.2212, 4.813.

Series solution of ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series. Bessel functions.

10.2211 Higher Applied Mathematics II — Vector Analysis S1 L1½T1

Prerequisite: 10.011 or 10.001 (DN). *Excluded:* 10.2111.

As for 10.2111 but in greater depth.

10.2212 Higher Applied Mathematics II — Mathematical Methods for Differential Equations S2 L1½T1

Prerequisite: 10.2211. *Excluded:* 10.2112.

As for 10.2112 but in greater depth.

10.301 Statistics SA F L1½T½

Prerequisite: 10.001 or 10.021C. *Excluded:* 10.331, 10.311A, 10.311B, 10.321A, 10.321B, 45.101.

Probability, random variables, independence, binomial, Poisson and normal distributions, transformations to normality, estimation of mean and variance, confidence intervals, tests of hypotheses, contingency tables, two sample tests of location, simple and multiple linear regression, analysis of variance for simple models.

10.331 Statistics SS F L1½T½

Prerequisite: 10.001 or 10.021C (CR). *Excluded:* 10.311A, 10.311B, 10.321A, 10.321B, 10.301, 45.101.

An introduction to the theory of probability, with finite, discrete and continuous sample spaces. The standard elementary univariate distributions; binomial, Poisson and normal; an introduction to multivariate

*Entry to General Mathematics IA is allowed only with the permission of the Head of the School of Mathematics, and that permission will be given only to students who do not qualify to enter General Mathematics IB.

**If a unit in this list is counted the unit above may not be counted.

†Mathematics 10.031 is included for students desiring to attempt only one Level II Mathematics unit. If other Level II units in Pure Mathematics or Applied Mathematics are taken, 10.031 Mathematics will not be counted.

‡Mathematics 10.032 is included for students desiring to attempt only one Level III Mathematics unit. If other Level III units in Pure Mathematics, Applied Mathematics or Theoretical Mechanics are taken, 10.032 Mathematics will not be counted.

distributions. Standard sampling distributions, including those of χ^2 , t and F. Estimation by moments and maximum likelihood (including sampling variance formulae, and regression); confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to experimental design: fixed, random and mixed models, involving multiple comparisons and estimation of variance components.

School of Psychology

Undergraduate Study

12.100 Psychology 1

F L3T2

Excluded: 12.001.

Introduction to the content and methods of psychology as a behavioural science, with emphasis on the biological and social bases of behaviour, relationship to the environment, and individual differences. Training in the methods of psychological enquiry, and in the use of elementary statistical procedures.

School of Textile Technology

Undergraduate Study

13.001 Introduction to Textile Technology

F L2

History of textiles. Properties of textile fibres. Unit operations in textile technology, including scouring, drying, disentangling, aligning, trash removal, length sorting, drafting, twisting, interlacing, interlooping, dyeing, pressing. Textiles as engineering structures. Mechanics in textiles, including rotary motion, principles of cam operation, gears and gear trains and machine elements, statics and dynamics in textile applications. Engineering Principles for textile technologists, physical and mathematical modelling.

13.111 Textile Technology I

F L3T5

Testing: Principles and practice of sampling textile materials. Statistical techniques. Physical testing of fibres and yarns.

Yarn Manufacture: Introduction, historical development. Principles and practices of manufacture of yarns on the cotton and worsted systems.

Fabric Manufacture: Principles of weaving. The mechanics of shedding, picking and beating up. Secondary and auxiliary mechanisms of looms. Basic cloth structure and weave representation. Principles of knitting. Techniques of loop formation in warp and weft knitting. Basic knitted structures.

13.112 Textile Technology II

F L5T7

Part A. Testing: Physical testing of fabrics. Evaluation of the serviceability of textile fabrics. Qualitative and quantitative assessment of damage in textile materials.

Part B. Yarn Manufacture: Principles and practice of yarn manufacture for wool on the woollen system and for other natural fibres such as silk, flax, jute, etc. Fancy yarns, paper yarns, twistless yarns. Manufacture of yarns from man-made fibres and blends with natural fibres.

Part C. Fabric Manufacture: Elements of woven fabric design. Derivative woven structures. Extra threads, compound cloths, woven pile fabrics, leno weaving. Elements of knitted fabric design. Derivative knitted structures. Techniques of needle selection in weft knitting. Raschel knitting.

Part D. Dyeing and Finishing: General descriptions of properties of dyes, dyeing assistants, solvents used in dyeing, water supplies and water treatment, machinery used in dyeing, classification and methods of application of dyes, textile printing methods. Objects of finishing and typical flow diagrams, the principles underlying and the technology of processes concerned with: the removal of impurities and discoloration; the improvement and elimination of deficiencies in properties of textile fibres.

13.113 Textile Technology III

F L4½T2

Part A. Testing and Yarn Manufacture: Functions of quality control. The organisation and integration of a quality control department in a textile factory. Fault investigation. Recent developments and trends in industrial textile testing methods. Recent research and development in yarn manufacture.

Part B. Fabric Manufacture: The mechanics of woven fabric formation. Pirnless weaving, narrow fabric weaving, multi-phase weaving. Woven fabric geometry. The mechanics of loop formation in knitting. Hosiery manufacture, knitted pile fabrics, shaped knitted structures. Knitted fabric geometry. Tufting, stitch-bonding, non-woven fabrics. Techniques of garment manufacture, the mechanics of sewing. Analysis of the Australian textile industry.

Part C. Dyeing and Finishing: The production of specified dimensions in textile fabrics. The development of specific properties: mechanical, surface finishes, protective finishes.

13.211 Textile Science I

F L2T1

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

13.212 Textile Science II**F L2**

Adhesion theory of friction, differential friction effects of wool, friction in textile processing. Static electrification of textile materials. Yarn structure, idealized helical yarn geometry, fibre migration, mechanics of twisted continuous filament and staple yarns. Structure of plied and blended yarns. Molecular interactions in fibres, elastomeric theory, viscoelasticity, spring and dashpot models. Eyring's theory of rate processes. Physical properties of macromolecular structures. Sorption in fibres. Polymerization kinetics, molecular weights of polymers, copolymers. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents, detergency.

13.213 Textile Science III**F L2T2**

Mechanical properties and rheological behaviour of fibres and fibre assemblies. Physical properties of textile materials including water adsorption, electrical properties, heat and moisture transfer. Comfort of clothing. Thermal insulation properties. Geometry of woven, knitted and non-woven fabric structures. Composite materials. Aspects of colour, colour mixing and colour vision. Introduction to adsorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour. Applications of colour measurement.

13.223 Advanced Textile Chemistry**F L2**

Chemistry of amino acids and proteins. Photochemistry of fibres and dyes. Physical-chemical concepts of dyeing.

13.233 Advanced Textile Physics**F L2**

(a) General analysis of textile structures. Flexure and torsion of a twisted yarn. Flexure and shear properties of fabrics. Mechanisms of fabric deformation.

(b) Varieties of macromolecules. Interactions with macromolecular structures. The physical properties of polymeric solids (including biopolymers). Absorption and the role of water in polymers.

13.311 Textile Engineering I**F L1**

Mill illumination. Elements of strength of materials — tension, compression, shear, torsion and bending. Dynamics of rotary motion and mechanical power transmission. Industrial electricity.

13.312 Textile Engineering II**F L1½**

Fluid flow. Applied heat, steam, air and heat transfer, air conditioning. Elements of automatic control. Introduction to Methods Engineering.

13.313 Advanced Textile Engineering**F L2**

(a) Same as (a) in 13.233 Textile Physics.

(b) Heat and mass transfer. Conveying of gases, fluids and solids.

13.411 Project**F T7**

Students are required to carry out a research project and to submit a thesis describing the results of their investigations. It is usual for students to be allocated projects in areas related to the particular course strand they are studying. The following examples are typical: *Textile Chemistry*: Topics related to the dyeing and finishing of textiles and to the chemistry of fibres. *Textile Engineering*: Engineering design work, some engineer-

ing aspect of textile processes, or some other topic of an engineering nature. *Textile Manufacture*: A topic related to textile processing or a topic of a commercial nature, such as some aspect of marketing, management or economic planning as applied to the textile industry. *Textile Physics*: The application of some aspects of physics to textile processing or to fibre, yarn or fabric structure and properties.

School of Accountancy

Undergraduate Study

14.501 Accounting and Financial Management IA**S1 or S2 LT4½**

Prerequisite: Nil.

The basic concepts of financial model building and information systems, including the double-entry recording system, the accounting cycle, income measurement and financial reporting, and an introduction to basic elements of taxation and auditing.

14.511 Accounting and Financial Management IB**S1 or S2 LT4½**

Prerequisite: 14.501.

Development of basic concepts introduced in 14.501 Accounting and Financial Management IA including management accounting and operations research, corporate reporting, business finance, system design, elementary computer programming and applications.

14.602 Information Systems IIA**S1 or S2 L2T1**

Prerequisites: 14.511 plus

2 unit Mathematics

or

3 unit Mathematics

or

4 unit Mathematics

or

approved studies in computer science

HSC Exam Percentile
Range Required
51-100

21-100

1-100

Introduction of Information Systems in business and commerce; systems design concepts; the theory of modelling; feasibility studies; internal control and auditing. An introduction to programming.

School of Economics

Undergraduate Study

15.001 Microeconomics I S1 or S2 L2T1½

Prerequisites:

	HSC Exam Percentile Range Required
2 unit A English or 2 unit English or 3 unit English	31-100 21-100 11-100

An introduction to micro-economic analysis and its application to contemporary policy issues. The indifference curve approach to consumer behaviour, income and substitution effects, market demand, consumer surplus. Isoquants, cost concepts, supply curves. Perfect and imperfect product markets, agricultural intervention schemes. Partial and general equilibrium, concept of efficiency, international trade and tariffs. Productivity of factors of production, labour markets, bilateral monopoly, wage fixing in Australia. Public goods, pollution and property rights.

15.002 Microeconomics II S1 L2T2

Prerequisites: 15.011 plus

	HSC Exam Percentile Range Required
2 unit Mathematics or 3 unit Mathematics or 4 unit Mathematics	51-100 21-100 1-100

Revealed preference theory of demand, index numbers and aggregation; externalities, time preference, consumer surplus and compensation concepts. Short and long-run costs, returns to scale, producer surplus and quasi-rents. Monopolistic competition, oligopoly, cartels, public enterprise. Investment criteria, benefit-cost analysis. Efficiency and equity trade-offs, microeconomic policy in a second best framework.

15.003 Macroeconomics III S1 L2T2

Prerequisite: 15.042.

Macroeconomic theory and policy, including an introduction to the theory of economic policy, the structure and dynamic characteristics of macro-models, recent developments in monetary theory and policy, theories of inflation and policy in a dynamic setting.

15.011 Macroeconomics I S1 or S2 L2T1½

Prerequisite: 15.001.

The economics of output, employment and inflation, including social accounting, consumption and investment functions, the Keynesian

goods market model, supply and demand for money, interactions between the goods and money markets in equilibrium and disequilibrium situations, inflation and the balance of payments.

15.042 Macroeconomics II

S2 L2T2

Prerequisite: 15.011 plus HSC results as for 15.002.

Extensions to the Keynesian model of income determination to include the government and overseas sectors and a more detailed examination of both demand and supply functions; money and financial institutions; an introduction to dynamic economics.

15.043 Marxian Political Economy

S1 L2T1

Prerequisite: 15.011.

Varieties of political economy, Marx and the classics, the Marxian system, Marxian economics since Marx, Marx and socialist planning, Marxian analysis of current economic problems.

15.053 Economics of Developing Countries

S2 L2T1

Prerequisite: 15.072 or 15.103 or 15.113.

Aspects of economic development in the less developed countries. The characteristics of these countries and the policies available to them, simplified models of underdevelopment, the phenomenon of structural change in the development process, the role of industrialization in promoting structural change, the international relationships of developing countries and strategies of development based on industry or agriculture.

15.062 Economics IID

S1 or S2 L2T2

Prerequisite: 15.011.

Unemployment and inflation and the balance of payments, goals of macroeconomic policies; introduction to monetary, fiscal and incomes policies; money, credit, and financial institutions; monetary policy in Australia, theory of fiscal policy, fiscal policy in Australia.

15.072 Economics IIE

S1 or S2 L2T2

Prerequisite: 15.011.

Positive and normative economics; value judgements in the competitive model and its role as a benchmark for evaluating microeconomic policies. Consumer and producer surplus as welfare criteria. Investment decisions in private and public sectors. Monopolistic markets, oligopolies, cartels, mergers, advertising and non-price competition, research and development, public regulation and control. International economic issues, including effects of government intervention in agriculture, mining and manufacturing. Foreign investment, including multinational corporations and joint ventures.

15.073 Natural and Environmental Resources Economics

S2 L2T1

Prerequisite: 15.002 or 15.012 or 15.072.

An introduction to the concepts and issues in the management and evaluation of natural and environmental resources.

15.082 Labour Economics**S1 L2T1***Prerequisite: Any Year II Economics subject.*

Theories of the labour market and segmented labour markets and applications to the Australian situation, including labour supply and demand, with emphasis on structural changes in the labour force, and the effects of technology and migration; work-leisure preferences, job satisfaction and worker participation; unemployment and under-employment; wage theory and practice, with reference to market forces, collective bargaining and government regulation; the Australian arbitration system and its inter-action with other wage determinants; wage differentials.

15.083 Public Finance**S2 L2T1***Prerequisite: 15.002 or 15.012 or 15.072.*

General aspects of public sector expenditure and its financing with special reference to Australia: the role of government in the economy; principles and types of public expenditure; tax sharing and revenue systems; economic and welfare aspects of different types of taxes and social service systems; inflation and tax indexation; loan finance and the public debt; fiscal policy, the Budget and the economy.

15.093 Public Sector Economics**S1 L2T1***Prerequisite: 15.002 or 15.072 with the approval of the Head of the Department of Economics.*

Public goods and social issues, such as poverty, health, education, transport and conservation. Theory and application of benefit-cost analysis. The pricing policies of public utilities.

15.103 International Economics**S2 L2T1***Prerequisite: 15.002 or 15.012.*

The international economy, the Australian balance of payments, international institutions. Comparative costs, gains from trade, effects of resource endowments on trade. Government intervention, including tariffs and quotas. Customs unions. Foreign exchange markets. Foreign investment. Balance of payments adjustment mechanisms, internal and external balance. International monetary system. Foreign aid. Proposals for a new international economic order.

15.143 Microeconomics III**S1 or S2 L2T2***Prerequisite: 15.002 or 15.012.*

Characteristics approach to demand theory, uncertainty, portfolio choice. Linear programming approach to the theory of the firm. Managerial and growth models of the firm. Multinational firms. Technological change. Market dynamics, expectations, speculation and futures markets. Input-output analysis, general equilibrium and welfare. Classical and neo-classical theories of income distribution. Income distribution in Australia.

15.163 Industry Economics and Australian Industrial Policy**S2 L2T1***Prerequisite: 15.002 or 15.012 or 15.072.*

The structure of industry: interrelationships between the role of the business firm and industrial structure; multinational corporations; factors affecting size-structure and performance such as economies of scale;

barriers to entry, vertical integration, diversification and mergers, patents, the development and transmission of technology; industrial policy in Australia with special reference to competition policy, foreign investment and mergers, and some specific industry policies (eg on motor vehicles, electronics, steel, petroleum).

15.501 Introduction to Industrial Relations**S1 or S2 L2***Prerequisite: Nil.*

For students enrolled in Faculties other than Commerce and Arts. It is designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Topics covered include the origins, evolution and operation of the Australian system of industrial relations; the structure and role of trade unions and employer bodies; the function of industrial tribunals such as the Australian Conciliation and Arbitration Commission and the N.S.W. Industrial Commission; wages structure and determination; employment, unemployment and retraining, the nature and causes of strikes and other forms of industrial conflict; the processes and procedures for conflict resolution.

Where appropriate to class composition, particular attention is paid to individual industries.

15.601 Economic History IA — The Making of Modern Economic Society**S1 or S2 L2T1½***Prerequisites:*

HSC Exam Percentile
Range Required

2 unit A English

31-100

or

2 unit English

21-100

or

3 unit English

11-100

Analysis of the forces that have determined the pattern and course of economic and social development in the twentieth century. Modern problems placed within an historical perspective including the relationship between economic growth, the emergence of the corporate economy, and the changing quality of life. The development of interdependence in modern economies in terms of the growth of big business, multinational enterprise, and changes in the distribution of income since the nineteenth century. Use of historical material as the basis of understanding of the background to the contemporary economic world.

15.611 Economic History IB — Australian Economic Development in the Twentieth Century**S1 or S2 L2T1½***Prerequisite: 15.601.*

The development of the Australian economy from the Long Boom and the deep depression at the end of the nineteenth century to the present day. Topics include: a general overview of Australian economic development and its main features; economic fluctuations and their consequences, especially the Great Depression of the 1930s; the rise of Australian economic institutions; changes in the philosophy of development and the role of the State; impact of war; migration and the development strategies of the States; the growth of manufacturing and the creation of an industrial base; problems of the rural sector; and changes in the Australian standard of living. Throughout the course particular attention is given to Australia's changing economic relations with other countries.

Biological Sciences

Undergraduate Study

Students must pay the laboratory fee and then use the receipt to obtain a 'course guide' during Orientation Week from the Biology Information Centre, Laboratory A, Ground Floor, Biological Sciences Building.

17.031 Cell Biology

S1

Prerequisite:

HSC Exam Percentile
Range Required
31-100

2 unit Science (any strand)

or

4 unit Science (multistrand)

31-100

Basic cell structure; membranes, organelles, prokaryotic and eukaryotic cells; cellular locomotion; basic biological molecules; enzymes; structure and metabolic roles, cellular compartmentalization and enzyme function; diffusion, osmosis and active transport; theory of inheritance, linkage, gene interaction, sex determination, mutation, selection and evolution; information transfer and protein synthesis.

17.021 Biology of Higher Organisms

S2

Prerequisite: 17.031.

The diversity of living things and the ways in which they have adapted to varying environments. Emphasis on flowering plants and vertebrate animals, and the complex organ systems they possess. The structure and function of these organs, as well as their coordination and control, examined in practical experiments to form the basis of lecture and tutorial programs.

and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. *The Use of Human and Physical Resources*: Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. *Production and Quality Control*: Control of jobbing, repetitive batch and continuous production. Manufacturing organizations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. *Introduction to Inventory Control*: Analysis of some engineering planning decisions. *Introduction to Operational Research*: The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

18.131 Operations Research

Introduction to Operational Research: The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

18.551 Operations Research

F L2T1

Prerequisites: either 5.071 and 18.021 or 10.031, 10.331 and 18.121.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models, and simulation will be introduced. These techniques will be applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis will be included.

School of Nuclear Engineering

Undergraduate Study

Department of Industrial Engineering

Undergraduate Study

18.121 Production Management

F L3T0

Prerequisites: 10.031, 10.331.

Engineering Economy: Economic objectives of the firm. Economic measures of performance: net present value, annual equivalent value

23.051 Nuclear Power Technology

F L2½T½

Atomic nuclei, radioactivity, neutron reactions, fissile and fertile materials, nuclear conversion and breeding cycles, plutonium. Criticality requirements, heat removal, control and safety of nuclear reactors. The thermal, hydraulic and structural aspects of gas and liquid cooled thermal reactors and liquid metal cooled fast breeder reactors. The status of fusion research and development. The technology, safety, economics and environmental impact of nuclear fuel cycles, from mining, through enrichment, fabrication and burnup to waste disposal. Comparative assessment of nuclear, fossil and alternative energy systems in local and global contexts.

School of Applied Geology

Undergraduate Study

New course 3000 subject.

25.110 Earth Materials and Processes S1 L2T4

Prerequisites:

2 unit Science (any strand)
4 unit Science (multistrand)

HSC Exam Percentile
Range Required
31-100
31-100

Constitution of the Earth: The Earth and the Solar System. The interior of the Earth: the crust and its chemical composition, gravity and isostasy. Minerals and rocks, economic mineral deposits.

Earth Processes: The origin of igneous rocks; plutonism and volcanism. The geological cycle. Weathering processes, soil formation and landforms. The origin of sedimentary rocks; transportation, deposition, lithification. Arid, glacial and periglacial processes. Geological time. Metamorphism and metamorphic rocks. Structural geology; classification and origin of faults and folds. Quaternary stratigraphic sequences, neotectonics.

Field Work of up to two days is a compulsory part of the subject.

25.112R Geology for Mining Engineers IIA

Prerequisite: 25.520.

Elements of stratigraphy, palaeontology and petrology. Environments of formation and tectonic setting of sedimentary, metamorphic and igneous rocks. Descriptive structural geology. Interpretation of geological maps. Ore genesis. Descriptive mineralogy of ore deposits. Introductory mineralogy. Weathering and element redistribution. Geological, geochemical and geophysical aspects of exploration. Processing of exploration data.

Laboratory Work: Examination of rocks in hand specimen and thin section. Examination of hand specimens of economic minerals. Mineralogical examination of ore mineral suites. Study of geological maps of economic mineral deposits.

25.120 Earth Environments and Dynamics S2 L2T4

Prerequisite: 25.110.

Earth Environments: Introductory palaeontology, including the evolution of life, invertebrates and vertebrates. Principles of stratigraphy. The stratigraphy of New South Wales: Broken Hill, Lachlan Orogen, New England Fold Belt and Sydney Basin. Introductory stratigraphy of Australia from the Precambrian to the Recent. The mineralogical study of rocks; techniques and significance of mineralogy. Structural geology; stereographic and statistical treatment of structural data.

Earth Dynamics: The evolution of ocean basins; sea-floor spreading and sea-level changes. Climates of the past. Geophysical methods of exploration; seismology and earthquake prediction. Plate tectonics and continental drift.

Field Work of up to four days is a compulsory part of the subject.

25.122R Geology for Mining Engineers IIB

Prerequisite: 25.520.

Structural geology; Wulff and Schmidt net problems and rose diagrams. Applications of structural analysis in the study of structure of ore deposits and mine design. Regional stress distribution in rock masses. Residual stress fields. Occurrence of placer ore deposits. Descriptive mineralogy of non-metallic deposits such as phosphates, clays, shales, limestones, rock construction materials, abrasives, and refractories. Groundwater geology: pressure, flow and storage of water in rocks, with particular reference to fissured rock masses. Energy resources: the geology of coal, oil, natural gas, uranium and geothermal power. Sampling: statistics, errors, limitations and methods.

Laboratory Work: Exercises in structural analysis including the analysis of structure of an ore deposit. Hand specimen examination of non-metallic economic minerals. Exercises in groundwater hydrology.

25.201R Mineragraphic Laboratory Work

Comprises the mineralogy and Introductory Mineragraphy topics from 25.112R Geology for Mining Engineers IIA.

25.211 Earth Materials I S1 L2T4

Prerequisite: 25.120.

Mineralogy: Principles of optical crystallography and the use of the polarizing microscope. Chemical and physical properties of rock-forming minerals. Mineral identification.

Igneous Petrology: Occurrence, classification and origin of igneous rocks. Fractional crystallisation and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology relating to plate tectonics.

Practical: Macroscopic and microscopic examination of rock forming and ore minerals and igneous rocks in the field and the laboratory.

Field Work of one day is a compulsory part of the subject.

25.212 Earth Environments I S1 L3T3

Prerequisite: 25.120.

Sedimentology: Flow regimes and bedding forms, sedimentary structures. Flume experiments. Modern and ancient sedimentary environments of deposition: alluvial, deltaic, coastal, shelf and deep sea. The facies concept.

Stratigraphy: Stratigraphic classification including the Code of Stratigraphic Nomenclature. Time in stratigraphy. An introduction to radiogenic methods of age determination: ^{14}C , K/Ar, Rb/Sr and fission track methods. The evolution of continental margins and geosynclines. Geological evolution of the New England Orogen.

Palaeontology: Morphology and stratigraphic distribution of invertebrates, including Foraminifera, Brachiopods, Mollusca, Arthropoda, Protochordata and Echinodermata. Introductory palaeobotany. Palaeoecology. Biogeography. Trace fossils. Reef building organisms and the evolution of reefs.

Field Work of up to five days is a compulsory part of the subject.

25.221 Earth Materials II**S2 L3T3**

Prerequisite: 25.211.

Sedimentary Petrology: The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The chemically formed sedimentary rocks including the phosphates, zeolites, evaporites, ferruginous and siliceous deposits.

Metamorphic Petrology: Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies.

Structural Geology: Origin, classification and description of structures in rocks. Techniques of stereographic projection of structural elements and analysis of simple fracture systems. Tectonics and tectonic analysis.

Field Work of up to eight days is a compulsory part of the subject.

25.223 Earth Physics**S2 L2T4**

Global Geophysics: Principles of gravity, geomagnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution, dynamic processes and major tectonic features of the earth.

Exploration Geophysics: Physical properties of rocks and soils. An introduction to electrical, electromagnetic, seismic, gravity, magnetic and radiometric methods of geophysical exploration. Application of these methods in the search for mineral deposits, petroleum, coal and groundwater and in civil and mining engineering projects.

Photogeology: The use of air photos for geological mapping and geomorphological evaluation of land. Techniques and principles of photo-interpretation and multi-band photography. Photo-interpretation of folds, faults, joints, bedding, limestone, intrusive igneous rocks, volcanic rocks, alluvial fans, terraces, slopes, landslides, coastal and tropical landforms, relationships between geology, drainage, soil and vegetation, orebody expression gossans, colouration halos. An introduction to remote sensing.

Field Work of one day is a compulsory part of the subject.

25.301R Geoscience IIIA**F 3 hpw**

Stratigraphy, palaeontology, oceanography.

25.302R Geoscience IIIB**F 3 hpw**

X-ray crystallography, mineralogy, metamorphic petrology, structural geology, tectonics.

25.303R Geoscience IIIC**F 3 hpw**

Igneous petrology, geochemistry, clay mineralogy, sedimentary petrology.

25.304R Geoscience IIID**F 3 hpw**

Economic geology, mathematical geology, geophysics.

25.311 Earth Materials III**S1 L2T4**

Prerequisite: 25.221. *Co-requisite:* 25.326.

Mineralogy: Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separation. Mineral characterization.

Geochemistry: Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms.

25.321 Earth Materials IV**S2 L3T3**

Prerequisite: 25.311.

Clay Mineralogy: The structure and properties of the clay mineral groups including the kandites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals.

Advanced Igneous Petrology: Origin of silicate liquids. High pressure and low pressure fractionation. Liquids and fluids. Nature of the Upper Mantle. The use of trace elements and isotopes are petrogenetic indicators. Practical petrography and literature studies of igneous suites. Field study.

Advanced Metamorphic Petrology: Facies series. Metamorphic reactions. Isograds. Mineral assemblages as geobarometers and geothermometers. Fluids in metamorphism. Fabric. Relationships of deformation and recrystallization. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic rocks.

Field Work of up to six days is a compulsory part of the subject.

25.312 Earth Environments II**S1 L3T3**

Prerequisite: 25.212. *Co-requisite:* 25.326.

Stratigraphy: Biological and physical methods of correlation. Definition of international stratigraphic boundaries, stratotypes and reference points. The development of the Precambrian craton of Australia. The geological evolution of eastern Australia, particularly the late Palaeozoic and Mesozoic history of the Tasman Mobile Belt. Intracratonic basins of western and southern Australia and the effects of the dispersal of Gondwanaland. Geological evolution of the northern margin of the Australian plate, particularly the Mesozoic to Recent of Papua-New Guinea. Stratigraphic and structural evolution of aulacogenes.

Palaeontology: Theories of biological classification. The origin and early history of life. Processes and theories of evolution. Functional morphology. Practical applications of palaeontology.

Sedimentary Basin Analysis: Techniques of sedimentary basin analysis and data presentation: outcrop, borehole sections and logs, seismic sections. Structure, isopach and lithofacies maps. Seismic stratigraphy. Analysis of sedimentary facies and sequences in fluvial, deltaic, nearshore and deepwater environments. Interaction of sedimentation and structure in tensional, compressive and strike-slip tectonic regimes. Basin evolution.

25.313 Exploration and Data Processing**S1 L4T2**

Prerequisite: 25.223.

Exploration Geophysics: The practice and theory of geophysics as a basic tool of geological exploration with applications in areas of energy, mineral and ground-water resources and engineering projects.

Mathematical Geology: An introduction to develop proficiency in the acquisition, display and analysis of geological data utilizing digital computer processing. Elementary descriptive and inferential statistics and sampling. Fortran programming language (including hands-on computing experience). Analytical methods of mathematical geology including time series analysis, Markov Chain analysis, map analysis and

multivariate identification and classification techniques. A practical approach is adopted throughout whereby the student makes extensive use of a library of programs implemented on the University's CDC multi-mainframe Cyber 72/171 installation for processing and interpretation of real data.

Field Work of up to five days is a compulsory part of the subject.

25.314 Mineral and Energy Resources I

S1 L3T3

Prerequisite: 25.221. *Co-requisite:* 25.311.

Metallic Resources: Classification and origin of ore deposits, geochemical processes, research methods. Orthomagmatic, hydrothermal, porphyry, volcanic-sedimentary, Mississippi Valley type, chromium, iron, manganese ores, residual and mechanical ores. Introduction to mineral exploration. Laboratory study of hand specimens, thin sections and polished sections of various ore types; study of selected mining areas representing various genetic types of ore.

Economic Mineralogy: Nature of reflected light. Orthoscopic and conoscopic rotation, dispersion phenomena. Microhardness and reflectivity, etch tests, XRD and microprobe techniques. Ore textures and their interpretation. Phase relations and paragenesis of ore minerals. Practical work in optical properties of ore minerals, hardness and reflectivity measurements; study of selected ores and ore minerals under the microscope including textural studies.

Field Work of up to four days is a compulsory part of the subject.

25.324 Mineral and Energy Resources II

S2 L3T3

Prerequisite: 25.312.

Non-metallic Resources: Factors critical to the occurrence of oil, natural gas, oil shale and coal. Geochemistry of hydrocarbons and formation fluids. Typical Australian and overseas occurrences of petroleum. Techniques of petroleum exploration, assessment and development of reserves. Introduction to coal petrology. Geological controls on the formation and distribution of coal. Occurrence and economic use of non-metallic products including phosphates, bauxites, beach sands and industrial minerals.

Advanced Structural Geology: Analysis of structural elements at the microscopic, mesoscopic and macroscopic scales. Modern methods of petrofabric analysis. Detailed studies of the analysis of metamorphic terrains, eg Otago Schist, Cooma Complex.

Field Work of one day is a compulsory part of the subject.

25.325 Engineering and Environmental Geology

S2 L4T2

Environmental Geology: Hydrodynamics of pollutants and water quality principles. Domestic, industrial and radioactive waste disposal, deep well injections. Geological hazards and urban planning. Environmental impacts of dams, mineral exploration, mining and impact statement techniques. Water resources law and pollution, land use conflicts.

Hydrogeology: The hydrological cycle; confined and unconfined groundwater. Hydrological characteristics of rocks and their measurement. Pump tests. Aquifer boundaries. Exploration for groundwater, development and monitoring of groundwater resources. Groundwater flow nets. Case studies on the Great Artesian Basin and on the Murrumbidgee area.

Geomechanics: Rock and soil masses and their engineering behaviour. Influence of composition and fabric. Discontinuities in rocks and soils and their analysis for engineering purposes. Mechanical properties and their measurement. Stress-strain theory.

Coastal Geology: The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes. Investigation techniques.

Field Work of up to three days is a compulsory part of the subject.

25.326 Geological Techniques

S2 L3T3

Prerequisites: 25.212, 25.311.

Geochemistry: Modern destructive methods of rock and mineral analysis. Non-destructive methods; X-ray fluorescence spectroscopy and electron probe microanalysers.

Geological Surveying: Levels, tachometers and theodolites. Field techniques. Precision of angular measurements. Stadia surveying. Levelling. Field computations. Closed and open traverses. Coordinates and their computation.

Sedimentology: Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters.

Field Mapping: Geological mapping in a complicated geological terrain. Geological report writing and cartography.

Field Work of up to ten days is a compulsory part of the subject.

25.411 Resource Geology

Geophysics: The planning of geophysical surveys within the context of overall exploration and engineering development programs. Geological interpretation of geophysical data and discussion of selected case studies.

Resource Economics: An introduction to the role of earth resources in industrial society; availability of resources and consideration of grade, price, economic, technical and political factors. Distribution, production, consumption and trade in minerals. Supply adequacy and resource assessment. Review of Australian and New South Wales mineral industry. Economics of engineering geological works.

Mineral Exploration: Use of geology in mineral exploration and area selection; principles of exploration geochemistry; radiometric and remote sensing methods, exploration drilling; ore reserve estimation; exploration ground tenure in New South Wales.

Engineering Geology: Rock slope stability analysis and stabilization techniques for mine developments. Ground water control and hydrogeological principles applied to mineral and energy resource development: mine dewatering.

World Evolution: Precambrian: global distribution and concepts; the Archean and Proterozoic of Australia; crustal development and the role of plate tectonics; special conditions and mineral resources. Stratigraphic and tectonic aspects of the Phanerozoic.

Field Work of up to ten days is a compulsory part of the subject.

25.412 Mineral and Energy Resources

Students taking this option are expected to show preference for either mineral or energy resources. Projects, lectures, tutorials and seminars are designed accordingly.

Mineral Resources: A major part is a student field-laboratory research project in some aspect of mineral resources. This may be a general geological project, or a specialised mineral exploration project, eg, geochemical, geophysical, mineralogical, etc. During the first session only there are additional lectures/seminars that follow on from 25.411 to give more detailed appreciation of various aspects of mineral resources and include exploration management, mine evaluation,

exploration geochemistry, exploration geophysics and mathematical geology. The content and extent of tuition in these subjects varies from year to year according to student requirements.

Energy Resources: A major section consists of a field mapping project in a sedimentary terrain. Depending on students' requisites, specialised field/laboratory studies are arranged in sedimentology, macro- and micropalaeontology, palynology, mathematical geology, geophysics and well-log analysis. Where possible, projects are directly related to problems of coal and petroleum occurrence. During the first session attendance is expected at lectures/seminars described in the Mineral Resources section above and of common interest to understanding evaluation and exploitation of energy resources.

25.413 Engineering and Environmental Resources

A major part is a field/laboratory research project in some aspect of engineering or environmental geology. During the first session additional lectures are given on: foundation geology; construction materials; rock weathering and fabric analysis applications to engineering problems; site investigations; practical construction geology; soil slope stability analyses and stabilization; geomechanical principles; engineering geophysical techniques; engineering geological case histories; and advanced geological surveying applied to engineering works.

25.510 Geology for Geomorphologists and Pedologists

S2 L2T3

Prerequisites: 25.211, 25.221, 25.212.

Clay Mineralogy: The structure and properties of the clay groups, including the kandites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. **Sedimentology:** Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters. **Coastal Geology:** The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes. Investigation techniques.

25.520 Geology for Engineers I

Outline of the main branches of geology and their application to Mining Engineering. Introduction to geomorphological processes and resulting landforms. Fundamentals of the atomic structure of minerals including major rock-forming minerals and ore minerals, their crystal symmetry, their physical and chemical properties. **Igneous Rocks:** formation, texture, composition and classification of the more important igneous rocks. **Sedimentary Rocks:** processes of formation and depositional environment, composition and classification. **Metamorphic Rocks:** metamorphic processes and metamorphic structures, classification and description of metamorphic rocks. Physical properties of rocks including porosity, permeability and capillarity. Weathering processes of rocks and minerals. Deformation of rocks and the resulting effects such as folds, faults, joints and foliation. An introduction to modern theories of tectonism. Integration of geological observations.

Practical Work: Laboratory work consists of exercises related to the Lecture course: geological mapping including structure contour problems. Study of minerals and rocks in hand specimens.

Field Tutorials: Two field tutorials are conducted at which attendance is compulsory. Satisfactory reports must be submitted.

Note: Total hours: 56. The course is divided equally between lectures and laboratory work. Field Tutorial hours are additional.

25.521 Geology for Mining Engineers II

Palaeontology and Stratigraphy: principles of stratigraphy; the use of fossils in stratigraphic correlation and bore logging. **Structural Geology:**

elements of structural geology; stereographic projection and fracture analysis applied to mining operations. **Geology of Fuels:** origin of coal, oil and natural gas; stratigraphic and structural considerations of oil and coalfields. **Hydrogeology:** principles of hydrogeology. Transmission of ground water in rocks and soils applied to mining operations. **Ore Deposits:** mineralogy of industrially important metallic and non-metallic minerals; theories of ore formation including secondary enrichment processes. **Exploration Procedures:** theories and application of exploration techniques in mineral and coalfield exploration including geological and geophysical methods. **Field Tutorial:** a geology field excursion is held at the end of Session 1; attendance is compulsory.

25.532 Advanced Engineering Geology

Prerequisite or co-requisite: 8.272.

The fabric of rocks at various scales; fabric analysis at the mesoscopic scales; the influence of anisotropy on rock properties; engineering applications. The role of geological structure in determining the stability of slopes and excavations; probability analysis of structures in slope studies; case histories. Petrology of rock and earth construction materials; fabric changes with weathering; soil fabrics; engineering aspects, and engineering classification of weathered rocks.

25.541 Mineralogy (Applied Science Course)

Crystallography, crystalline state and crystal growth of minerals. Fundamentals of the atomic structure of minerals, with examples of Bravais lattices and introduction to space lattice group theory. Physical properties of crystals; cleavage, gliding, secondary twinning, elasticity. Elements of crystal optics in polarized light. Classification, descriptive mineralogy and occurrence of primary and secondary minerals with special emphasis on economic metallic and non-metallic minerals. Introduction to petrology. Mode of formation of minerals and ores in the igneous, sedimentary and metamorphic cycles. Examples of principal types of economic mineral deposits, their mode of formation, paragenesis, textures and intergrowths. Elements of fuel geology, construction and refractory materials. **Laboratory: Crystallography** — Examination of crystals and crystal models for symmetry. Stereographic projection of crystals. **Optical Mineralogy** — Examination of minerals and rocks in transmitted and incident light using the polarizing microscope. Determination of refractive indices of crystal fragments by the immersion method. **Descriptive and Determinative Mineralogy** — Macroscopic examination of common minerals with emphasis on economic minerals. Study of texture and intergrowths of common mineral parageneses including the principal rock types in which they occur.

Servicing Subjects

25.621 Marine Geology I

25.622 Hydrological and Coastal Surveying

25.631 Marine Geology II

25.632 Estuarine Geology

25.634 Marine Mineral Deposits and Exploration

25.6341 Marine Mineral Deposits and Oceanic Minerals

25.6342 Exploration and Seismic Methods

25.635 Marine Resources

Graduate Study

25.335G Applied Geophysics Project Assignment

A project involving interpretation of geophysical field data which may be collected by the students.

25.402G Hydrogeology S1 L1½T1½

Surface and sub-surface methods of geological and geophysical investigation; ground water exploration of confined and unconfined aquifers. Geological and hydraulic characteristics of rocks; aquifer boundaries, groundwater storage and quality. Hydraulics of wells. Hydrogeological systems analysis, including computer methods, mapping techniques and groundwater resources evaluation. Hydrogeology of arid and semi-arid zones. Case history studies of groundwater fields.

25.403G Project (Engineering Geology Graduate Course) S2

The project is a research investigation consisting of field and laboratory work in any of the disciplines. Engineering Geology, Hydrogeology, Environmental Geology.

25.404G Environmental Geology S1 L1½T1½ C3

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative and extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non-technical people. Geological legislation for water resources and waste disposal.

25.405G Engineering Geophysics S1 L2T1

Shallow seismic refraction: elastic theory, sources and equipment. Determination of fracture index, rippability. Applications to damsites, highways, depth of weathering, material quality. Seismic reflection. Sparker and boomer profiling, side scan sonar with application to coastal harbours, sewer outfalls. Electrical methods: direct current geoelectric theory, resistivity sounding and profiling with applications to determination to bedrock depth, location of water table, clay filled dykes, shear zones. Magnetic, electromagnetic and gravity methods as applied; to engineering problems. Geophysical well logging: resistivity, self-potential, gamma ray and sonic logs applied to determination of rock properties and location of clay-filled joints.

Field tutorials: Short field tutorials are included.

25.406G Geological Basis of Geomechanics S1 L2T1

Geomechanical behaviour of soils. Stress-strain theories, elasticity and plasticity. Clay-water reactions and their relation to soil behaviour. Laboratory and field investigation techniques, including CBR, Proctor, field penetrometer, triaxial compression. Engineering classification of soils and soil stabilization. Elasticity and strength properties of rocks,

state of stress in virgin rock masses, residual tectonic stresses, stresses about rock openings and beneath point loads. Mechanical classification of rocks. Rock mechanics testing procedures.

25.407G Geopollution Management S1 L1½T1½ C3

Material properties and hydrodynamic factors influencing surface and subsurface flow of pollutants in rocks and soils. Dispersion theory and modelling for pollutants in aquifers. Water quality and the problems of standards. Use of field instruments for quality determination. Geological and technological factors in waste disposal: domestic and industrial wastes, including the Rocky Mountain Arsenal Well case study, deep well injection methods. Management of radioactive wastes, waste disposal problems in limestone areas. Case studies of aquifer pollution and practical measures for preventing pollution. Rational planning of water resources for industrial and domestic use.

25.408G Engineering Geology S1 L2T1

Co-requisite: 25.406G.

Soil and rock slope stability analyses and stabilization methods: geological, geomorphic and engineering considerations. Construction materials exploration, evaluation and assessment of standards, concrete aggregate requirements, tests. Practical site investigation procedures: drill core logging, R.Q.D., drilling programs. Engineering classifications of weathered rocks. Weathering and engineering works. Discontinuities in rock masses, analysis, influence on engineering properties. Soil fabric analysis; principles and application to engineering behaviour of soil masses. Engineering geology organization; contracts; critical path analysis and geological investigations; communication between geologists and engineers.

Several field tutorials form part of this subject.

25.409G Foundation Geology S1 L1½T1½

Co-requisite: 25.406G.

Foundation principles: investigation, design, construction. Improving rock and soil. Geology of dam, road, airfield, bridge and building foundations. Geology of tunnels and large underground openings. Foundations on unstable landforms and in seismically active regions.

25.410G Coastal Environmental Geology S1 L1½T1½ C3

The shoreline processes; calculation of beach profiles and littoral drift. Longshore drift and net sand movement. Coastal protection: groins, beach nourishment. Foundations of coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes in estuaries. Man's impact on the water environment. Investigation techniques. Marine hydraulic works: sewage disposal, thermal pollution.

25.411G Arid Zone Engineering Geology S1 L2T1 C3

Geological characteristics of arid zones. Weathering of rocks and soil development under arid conditions. Engineering properties of weathered rocks and soils. Hydrogeology of arid zones. Engineering geology of water storages and traffic routes. Construction materials. Planning engineering geology and hydrogeology investigations with inadequate data. Includes a field exercise at Fowler's Gap Arid zone Research Station of at least 3 days duration.

25.412G Project in Terrain Management **S2 T9** C9**

A practical exercise to illustrate the application of engineering geology in terrain evaluation and management, to be carried out at Fowlers Gap Research Station. A report is required.

25.413G Research Project in Terrain Management **F T9** C18**

A substantial research project involving the application of engineering geology in terrain evaluation and management. Involves fieldwork at Fowlers Gap Research Station. A report is required.

25.800G Seminar **S1* Sem 2**

A weekly seminar to present and discuss student papers on exploration topics: speakers from industry are invited to attend and present papers from time to time.

25.801G Geology in Exploration I **S1* L4**

The development of conceptual models in mineral exploration and formulation of exploration programs. Consideration of significant guides to ore including structure, lithology, alteration and gossans.

25.802G General Introduction to Exploration Geophysics **S1* L3**

A basic introduction to the theory and practice of exploration geophysics, including treatment of applications and limitations of the main methods of seismic, electric, electromagnetic, gravity, magnetic and radiometric methods to geological problems in hydrocarbon, coal, ground water, mineral and engineering exploration. Treatment includes fundamental aspects of the method and case histories illustrating applications areas.

An integrated, geological, geophysical and geochemical field tutorial survey camp of seven days' duration is an integral part of this course.

25.803G Introduction to Exploration Geochemistry **S1* L3**

Basic principles of exploration geochemistry and the role of exploration geochemistry in the generalized exploration sequence. Principles and problems of anomaly recognition. Examples of main applications.

25.804G Introduction to Data Processing and Interpretation **S1* L3**

FORTAN and computer programming; use of terminal facilities. Basic data storage and retrieval. Simple interpretative procedures for exploration data.

25.805G Resource Economics I **S1* L1**

Interdependence of political, economic and technical factors in mineral resource supplies. Examination of the main factors in reserves and resources estimation.

25.807G Exploration Geophysics **S1* L6**

An introduction to the theory and practices of all geophysical methods in exploration for energy, minerals, groundwater and engineering applications. These will include seismic reflections, seismic refraction, electrical, electro-magnetic, magnetic, gravity and radio-metric methods of exploration, including the planning and conduct of field surveys for general and particular applications, and the theory and practice of the interpretation of geophysical results in terms of geological problems, conditions and occurrences.

25.808G Exploration Project **S1* T6**

Interpretation of exploration case-history data designed to familiarize students with the type of information normally required by exploration companies.

25.811G Advanced Geology in Exploration **S1† L4**

Definition of the geological environment and search techniques for major categories of mineral deposits including porphyry coppers, carbonate- and shale-hosted lead-zinc ores, volcanogenic massive sulphide ores, vein and sandstone uranium. Geological aspects of reserve estimation. Exploration case histories.

25.815G Resource Economics II **S1† L2**

Distribution, production, consumption and trade in minerals. Supply adequacy and resource assessments and projected requirements. Review of the Australian minerals industry in a global context.

25.816G Remote Sensing **S1† L4**

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infra-red remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

25.817G Mining Law and Exploration Management **S1† L1**

Mining law in Australia with special reference to land tenure and lease acquisition; organization and management of exploration programs.

25.818G Exploration Project **S1† T6**

Design and costing of exploration program by students. This may be based on simulated conditions or actual situations.

25.819G Field-Laboratory Project **S2**

An individual exploration project that requires the student to acquire field and laboratory data on geological, geochemical and geophysical aspects of an actual exploration problem. As far as possible the project should be designed in consultation with the exploration industry. A report is required.

*Weeks 1-7 only.

†Weeks 8-14 only.

**Equivalent contact hours, but also including fieldwork out of session.

25.821G Geology in Exploration II S1† L2

Specialized search techniques for selected types of metallic ores, with appropriate case histories.

25.823G Advanced Exploration Geochemistry S1† L2T6

Detailed consideration of the main techniques with emphasis on soil, drainage and rock surveys. All applications and problems will be examined on the basis of case-histories of actual surveys. Special consideration is given to problems of applications under Australian conditions.

25.824G Advanced Data Processing and Interpretation S1† L2T2

Advanced concepts of data storage and retrieval; problems of display of geochemical data; multi-variate statistical data interpretation. Students are encouraged to supply their own data sets for processing.

25.827G Laboratory Methods S1† L1T3

Instruction in the main techniques of sample preparation and instrumental analysis appropriate to exploration geochemistry. Practical experience with AAS and XRF. Students are encouraged to supply their own samples.

25.828G Exploration Project S1† T6

Interpretation of exploration data from geochemical surveys; this may be based on data from actual surveys, or data generated by the students themselves.

25.829G Field-Laboratory Project S2

An individual research project designed to contribute to the solution of a practical exploration problem; as far as possible the project should be chosen in consultation with the exploration industry to ensure relevancy to current exploration problems. In general the project involves collection of field data and samples, chemical analysis of samples, and interpretation of the results. A report is required.

25.813G Geological Interpretation S1† T2

The geological interpretation of geophysical data and geophysical models in seismic electrical, electromagnetic, gravity and magnetic methods, including selected case studies from petroleum, coal, mineral and engineering exploration.

25.832G Advanced Exploration Geophysics S1† L16

An extension of, and considerable advanced treatment of the subject matter in 25.807G, in the theory and practice of field and interpretational procedures in all methods and aspects of exploration geophysics, including instrumentation, manual and electronic data processing and interpretation. Specific applications areas for prominent geophysical exploration techniques in the solution of relevant geological problems, are treated in detail in both field and theoretical aspects of the methods.

25.839G Field-Laboratory Project S2

Exploration geophysical project on one or more topics of relevance in energy, water, mineral or engineering exploration. Includes tutorial sessions and seminars on relevant topics of geophysical/geological/geochemistry exploration.

25.840G Seminar S1† Sem2

A weekly joint seminar of Mineral Exploration, Exploration Geochemistry, and Exploration Geophysics students who present papers on aspects of their own particular specialization. Outside speakers from industry and government organizations are invited to participate in the seminars from time to time.

25.915G Project in Hydrogeology

Small project involving the analysis of hydrogeological data from Fowlers Gap.

25.916G Research Project in Hydrogeology

Research project on some aspect of the hydrogeology of an arid region.

School of Geography

Undergraduate Study

27.111 Applied Physical Geography I F L2T4

Prerequisite:

2 unit Geography
or
3 unit Geography
or

*HSC Exam Percentile
Range Required*

71-100

31-100

†Weeks 8-14 only.

2 unit Science (any strand)	31-100
or	
4 unit Science (multistrand)	31-100
or	
2 unit Mathematics	71-100
or	
3 unit Mathematics	31-100
or	
4 unit Mathematics	11-100

A systematic introduction to physical geography as a basis for applied studies.

Principles of meteorology and climatology with particular emphasis on climatic controls at global and regional scales. Weather systems and forecasting methods. Climatic classification and the regional pattern of climates in Australia. Geologic and climatic factors in landforms and soils, and in the physiographic build and major landforms of Australia. Mass movement and hillslope form. River action and associated valley and channel forms. Coastal environments, processes and forms. Properties and types of soil, with emphasis on factors and processes controlling global and regional distribution. Soil profiles and laboratory measurement of soil properties. Principles of soil classification and mapping. Spatial organization of plants and animals, and factors and processes relating to that organisation. Composition, structure, population dynamics and classification of vegetation. Laboratory classes concerned with the interpretation of various forms of data in physical geography and their representation quantitatively and graphically.

27.133 Pedology S1 L2T3

Methodology of pedogenic studies and the application of these studies to the understanding of soil-landform relationships. Soil physical and chemical properties and their interrelationships, emphasizing clay-mineral structure and behaviour, soil solution chemistry, soil water movement and the application of these properties to elements of soil mechanics. Soil properties in natural, rural and urban landscapes, including assessment of soil fertility, swelling characteristics, dispersibility, erodibility and aggregate stability. Laboratory analysis of soil physical and chemical characteristics with emphasis on properties associated with land capability assessment. Statistical analysis of soil data and its application to mapping.

27.143 Biogeography S2 L2T3

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of man and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Composition, structure, productivity and environmental controls of heathland, woodland, grassland and rainforest communities. Management of vegetation in different climate regimes.

27.153 Climatology S2 L2T3

Physical bases for understanding microclimate. Processes of energy exchange at the earth's surface, and the atmospheric and terrestrial surface controls of the heat and mass budgets. Atmospheric diffusion. Wind profiles and atmospheric turbulence as affected by stability and surface properties. Determinants of the local and site-specific climatic environment, particularly topographic, surface cover and substrate

conditions. Urban climate and climate in relation to human comfort and health. Building and constructional design aspects of climate and applications of climatology in urban and regional planning. Climatic aspects of the development and utilization of solar and wind energy sources.

27.162 Geographical Statistics and Computing S1 L2 T2 and S2 L1 T1

Fundamental concepts in descriptive statistics and univariate inferential statistics; introduction to bivariate and multivariate statistics. Computer-compatible data assembly and storage; standard analyses with computer packages; simple BASIC and FORTRAN programming; typical case studies in Physical Geography exemplifying the above techniques.

27.163 Methods in Physical Geography F L½T1

Research design and data sources for studies in physical geography. Quantitative methods having application over several areas in physical geography, including forms of multivariate analysis, time series analysis, use of stochastic models including Markov applications, numeric taxonomic methods and simulation. Laboratory work includes use of CYBER and HP30 facilities. In Session 2 students undertake a project in their specialist areas based upon an application of one of the basic methodologies studied in Session 1.

27.172 Environmental Measurements F L2T4

Sampling strategies and survey methods for the collection of environmental data. Data analyses using laboratory and statistical methods. The collection and analyses of weather and climatic data, and the maintenance of meteorological stations. Methods of field surveying and instrumentation for the study of geomorphologic and hydrologic processes. Drainage basin morphometry, dynamics and function, including controls on run-off and sediment transport. The measurement of soil physical and chemical properties in the field and laboratory with special reference to plant growth and hydro-geomorphic parameters. The use of soil data in classification and mapping schemes. Measurement and description of vegetation. Vegetation survey, sampling and species abundance measure. Monitoring energy and nutrient flow and the effects of man on ecosystems.

27.173 Remote Sensing Applications S1 L1T2

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for their interpretation. Application of remote sensing for the assessment and mapping of land properties, resources and land use. Applications in resource and environmental management.

27.183 Geomorphology S1 L2T3

Beaches and their response to waves, currents and sediment movement. Barrier systems, lagoons and estuaries. Rock platforms. Quaternary sea level changes. Hydraulic geometry of stream channels, including effects of sediment transport and man's activities. Hillslope form, process and associated slope materials. Methods of slope measurement, analysis and survey. Hillslope models. Systems approach, equilibrium concepts and modelling in landform studies. Field projects in coastal and fluvial geomorphology, and laboratory time is devoted to statistical exercises using data collected from maps, airphotographs and in the field.

27.193 Environmental Impact Assessment S1 L1½

Rationale and basic objectives: standardized types of Environmental Impact Assessment (EIA), including Matrix Approach; adopted methods of EIA in NSW and other Australian states. Frequently used assessment techniques and their limitations: meteorological, hydrological, biological, socio-economic. Environmental decision making and planning under conditions of uncertainty. Local case studies exemplifying various techniques and issues. Trends, changes and likely future developments in EIA. Practical exercises representing components of typical EIAs.

27.194 Assessment and Management of Physical and Biological Resources S1 L6T6

A core of study relating to methods of assessment of resources and of natural and man-made environments; assessment of land capability and conservational management; evaluation of risk from natural hazards; application of remote sensing for mapping and assessing land, water and biological resources; investigational procedures relating to community and governmental perception and response. This core is supplemented by study in two of the following areas, chosen as to suit the project:

1. *Landforms* Methods of classifying and mapping land surface elements. Physiographic factors in catchment hydrology and flooding. Accelerated erosion and methods of monitoring and controlling it.
2. *Soils* Methods of classifying and mapping soils. Movement of water and nutrients through soils and problems of physical and chemical instability with differing land use. Soil properties in relation to the stability of natural or introduced ecosystems.
3. *Vegetation* Quantitative analysis of vegetation. Survey, classification, ordination and mapping of vegetation. Identification of environmental controls determining the distribution of vegetation communities and of individual component species. Biogeographic principles of reserve planning. Exploitation of population and population characteristics in pest control strategy. Organisms as indicators of environmental quality.
4. *Bioclimate* Classification and assessment of climate in relation to natural and agricultural ecosystems. The energy and mass budgets of distinctive plant communities and the aerial and soil microclimate of plant and animal habitats. Climatic factors in plant and animal disease incidence, and in the growth and spread of insect populations. Quantitative models for biometeorological forecasts and the assessment of biological productivity and phenology.

27.504 Projects in Applied Geography

Biogeography and Bioclimatology: study of the vegetation in an area, and detailed consideration of a problem arising from this survey, preferably with an applied aspect, or a study of the climate of some well defined plant or animal habitat as related to characteristics of the vegetative cover and substrate. *Economic Geography*: a problem in applied economic geography involving experimental design, the acquisition and manipulation of field data, and the presentation of a report. *Geomorphology and pedology*: an area study introducing soils-landscape relationships in a dynamic or chronologic sense; or a systematic study which may be primarily geomorphic or pedologic, but with some interdisciplinary aspect. To include a field element and a supporting laboratory program.

27.514 Practical Applications in Geography S2 T3

Seminars with practitioners in the fields of urban and regional analysis and environmental studies, including: environmental impact statements; research proposals; report writing; the roles of government agencies and consultants; and budgeting for research projects.

27.611 Applied Economic Geography I F L2T4/L2T1

Prerequisite:

HSC Exam Percentile Range Required

2 unit Geography or	71-100
3 unit Geography or	31-100
2 unit Economics or	71-100
3 unit Economics or	31-100
2 unit Mathematics or	71-100
3 unit Mathematics or	31-100
4 unit Mathematics	11-100

Emphasis is on basic concepts, themes and issues in economic geography. Topics include: spatial interaction and analysis of movement patterns; location principles; the organization of settlement patterns and the space economy; behavioural and decision-making processes. Australian case studies are stressed. Laboratory classes deal with handling and presentation of data in economic geography.

27.612 Applied Economic Geography IIA S1 L2T4

The exploration of concepts relating to the city as a complex system with emphasis on spatial structure and processes and change in the spatial organisation of urban areas. Particular emphasis is on industrial location, residential development, population distributions, and service provision.

27.613 Applied Economic Geography IIIA S1 L2T2

Selected topics in applied economic geography with particular reference to urban and regional analysis and planning.

27.622 Applied Economic Geography IIB S2 L2T4

Theoretical principles underlying the location of the firm and the spatial organization of land use are emphasized. Topics include: factor costs and the location problem; demand, scale and agglomeration; rent theory and location patterns; location decisions under conditions of uncertainty; linear models in location analysis.

27.623 Applied Economic Geography IIIB S2 L2T2

Selected topics in applied economic geography with particular reference to the spatial implications of economic, social, and technological change.

*Offered subject to availability of staff.

27.624 Geographic Thought and Perspectives S1 T3

Aspects of social science theory and philosophy as they relate to the development of human landscapes and as they enter into planning and policy making. Themes to include: The persistent utopian element; utilitarianism and positivist economic geography; conflict approaches; value-critical stances; the political economy critique; participation, advocacy and action-research; humanistic and welfare approaches; ideology and planning; theories of the state and the basis for intervention.

27.631 Geographic Data Analysis I S2 L1T3

Emphasis is on a variety of methods for measuring spatial associations and relationships within a hypothesis-testing framework. Laboratory work is based on the use of S.P.S.S. procedures.

27.632 Geographic Data Analysis II F L1T2

Focus is on inferential problems in the analysis of location patterns and the application of multivariate methods in economic geography, particularly multiple regression and factor analysis. Laboratory work is based on the use of the CYBER and FORTRAN language with particular reference to geographical information systems.

27.633 Geographic Data Analysis III F L2T4

Principles of research design; field survey methods; numerical taxonomy; non-metric measurement techniques; multivariate methods. Introduction to additional computer software. Student projects and development of Year 4 thesis topics.

27.642 Mathematical Methods for Spatial Analysis F L1T2

The application of selected mathematics to spatial problems including: Algebra of space and principles of system description using concepts of co-ordinate geometry; quadrat analysis and network theory; matrix algebra and the use of matrices in spatial analysis; differential and integral calculus in modelling geographic systems, optimization methods — constraint maximization; algorithmic methods including linear programming; stochastic processes.

27.644 Seminars in Applied Geography S1 T4

Seminars on selected topics relating to problems of rural areas; urban land-use; spatial activity systems; and regional problems and planning.

27.652 Geographic Information Systems S2 L2T1

An introduction to source material and published statistics of relevance to Economic Geographers; problems of geocoding and spatial identifiers; coding information and data banks; and automated cartography. Project work in the development of information systems for monitoring spatial change.

27.662 Urban and Regional Systems S1 L2T2**

Focus is on processes of change in urban and regional systems. Topics include: the spatial distribution of economic activities; the economic

structure of cities and regions; regional linkages and the transmission of economic change; input-output analysis; urban and regional growth and decline; concentration and dispersion of economic activities; regional disparities; policy issues in urban and regional development. Laboratory classes include methods of urban and regional analysis and an introduction to regional forecasting.

27.713 Marketing Geography* S2 L2T2

Spatial reality as a result of consumer and producer decisions. The relationship between consumer spatial behaviour and the pattern and structure of marketing establishments. Organisation and operation of the marketing function with emphasis upon the pattern of consumer orientated enterprises and the structure of market areas in intra-urban areas. Spatial behaviour of consumers including search and decision processes. Workshop seminars on analytical techniques and issues raised in lectures.

27.723 Transport Geography* S2 L2T2

The analysis of the transportation system in terms of its relationship with economic and geographical indicators. Focus is on network analysis, trip generation models, freight movement, transport impact studies and the transport energy problem. Lectures are accompanied by seminars which stress the consideration of major problem areas in transportation in Australia.

27.733 Regional Policy and Planning* S1 L2T2

Regional forecasting and techniques for evaluating regional plans are emphasised. Topics include: Regional information systems and budgets; exploratory and normative forecasting methods; time series projections; integrated forecasting models; cost-benefit analysis; planning balance sheets; goals — achievement matrix methods of evaluation; reviews of plans and programs for regional development in Australia. Lectures are accompanied by workshop sessions which concentrate on methodology.

27.743 Regional Population Analysis* S1 L2T2

The primary emphasis is on regional population estimation and forecasting with reference to Australian conditions and the use of Australian data. The secondary emphasis is estimation for regions in adjacent Third World countries. The population forecasting is handled within the framework of demographic theory and component analysis; migration analysis is given particular attention because of the importance of mobility in Australia. The derivation of regional and local social indicators in the context of population change and service provision in Australia.

27.753 Social Welfare and Urban Development* S1 L2T2

A consideration of welfare aspects of urban development, including: Social policies and urban structure; social costs and benefits of urban renewal especially in the inner city; growth centres and new towns; distributional aspects of social services; and spatial disparities in social well-being.

*Offered subject to availability of staff.

**Not offered in 1982.

27.763 Rural Resource Problems* S2 L2T2

Structural adjustment in agriculture; government intervention; rural land subdivision; competing uses for rural land; conservation/development conflicts; the future of country towns; depressed rural regions as poles of underdevelopment; economic and social organisations — family farms, agribusiness, village co-operatives and farm tourism; integrated rural planning initiatives. Emphasis on Australian cases with international experience as context. Workshops to emphasise planning applications.

27.773 Spatial Aspects of the Housing Market* S1 L2T2

Advanced residential location theory; housing market models; determinants of house prices and the cost of housing; residential growth on the urban fringe; inner city housing and urban renewal. Housing problems in Australia and the determination of housing policy.

27.783 Spatial Impacts and Opportunities* S1 L2T2

Selected problems in the location of public services and measurement of spatial opportunity; methods for assessing the local and regional effects of new facilities; multiplier models; and socio-economic impact studies.

27.793 Models of Spatial Systems* S2 L2T2

The design and development of models of spatial systems, including: Entropy maximisation methods; control theory; evaluation of alternative models; and case studies of models in urban and regional analysis.

Servicing Subjects**27.295 Physical Geography for Surveyors S1 L2T2****27.801 Introduction to Physical Geography****27.802 Introduction to Human Geography****27.811 Physical Geography****27.812 Human Geography****27.2813 Geographic Methods****27.2814 Geographic Field Methods****27.824 Spatial Population Analysis****27.825 Urban Activity Systems****27.826 Urban and Regional Development****27.834 Spatial Population Analysis (Advanced)****27.835 Urban Activity Systems (Advanced)****27.836 Urban and Regional Development (Advanced)****27.412 Coastal Geomorphology****27.860 Landform Studies****27.862 Australian Environment and Natural Resources****27.863 Ecosystems and Man****27.870 Landform Studies (Advanced)****27.872 Australian Environment and Natural Resources (Advanced)****27.873 Ecosystems and Man (Advanced)****27.880 Advanced Geographic Methods****27.890 Thesis and Associated Seminars****27.893 Honours Physical Geography****27.894 Honours Urban Geography****27.895 Honours Social Geography****Graduate Study****27.043G Remote Sensing Applications S1 L1T2 C3**

The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multi-temporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

27.202G Environmental Planning and Evaluation C3

Lectures and seminars on environmentalism and political economy, environmental information, impact assessment, and economic evaluation.

27.643G Geographic Data Analysis C2

Principles of research design; sampling and field survey methods; multivariate statistics; numerical taxonomy; spatial statistics.

27.672G Geographic Information Systems C2

Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping.

*Offered subject to availability of staff.

27.901G Geomorphology for Hydrologists **S2 L1½T1½ C3**

Geomorphological controls in the development of drainage systems. Geomorphology of drainage basins and channel networks. Forms of river channels. River floodplains and terraces. Drainage basins and networks as geomorphological systems. Geomorphology in predictive modelling of basin hydrological response and in the assessment of water resources. Geomorphology of representative basins. Short-term and long-term geomorphic changes. Air photo and map analysis of drainage basins and networks. Field study of fluvial landforms and drainage basins and networks.

27.902G Meteorological and Hydrological Principles **S2 L3T0 C3**

1. Meteorology: Heat and water balances of earth-atmosphere system. Global pressure, wind and climatic patterns. Atmospheric stability, temperature inversions, aerological diagrams. Synoptic and local wind systems, dispersal of atmospheric pollutants under various conditions of stability and wind. Precipitation and precipitation fallout. Weather forecasting with particular reference to forecasting pollution potential.
2. Hydrology: Catchment morphology. Precipitation: streamflow relationships; frequency analyses in hydrology. Drought and low flow analyses. Channel morphology and stream velocity characteristics, tidal estuaries, ocean currents. Dispersal of pollutants in flowing water.

27.904G Geomorphology for Engineering Geologists† **S2 L1½T1½ C3**

Landform expression of lithology and structure. Hillslope forms and processes. Climate, erosion and landforms. Landform evolution and systems theory. Geomorphology and soil erosion. Geomorphological background to coastal engineering problems. Forms of rivers and alluvial floodplains. Geomorphological approach to terrain evaluation. Exercises in the analysis and systematic description of terrain types from maps and airphotos. Field excursion on terrain assessment.

27.910G Geomorphology of Arid Lands **S1 or S2 L2T4 C6**

Physiographic, geologic and climatic determinants of arid landforms and landforming processes. Rock weathering and weathering products under arid environments. Desert hillslopes and hillslope processes. Geomorphic aspects of runoff on desert hillslopes and the initiation of channel networks; characteristics of desert drainage nets. Geomorphic aspects of desert streamfloods; forms of desert channels and floodplains. Desert playa regimes and the associated features of desert lake basins. Transport of sand and dust by wind and related aeolian landforms and surfaces. Inheritance in desert landscapes and geomorphic evidence of climatic change. Geomorphic aspects of accelerated wind and water erosion in deserts. Exercises in the photo-interpretation of desert landforms and in related geomorphic mapping.

27.911G Soil Erosion and Conservation **S1 or S2 L2T4 C6**

Climatic, vegetational, geomorphic and pedologic controls of erosion. Physical processes of sediment transport and deposition. Conservation measures for the prevention of erosion including constructional and management practices. Methods of assessing soil loss risk and erosion hazard evaluation.

27.912G Arid Zone Climatology **S1 or S2 L2T4 C6**

Definitions of aridity based on climatic data and their relevance at different scales from hydrologic and biologic considerations. Measures of precipitation effectiveness. Meteorological controls of aridity at global and regional scales, and distinctive features of arid climates over the world. Characteristics and physical controls of the radiation, water and heat budgets as commonly found within arid environments. Climate as a fact in resource utilization considered in terms of plant growth and development, animal ecology, insects and diseases, soil erosion, and human adjustments to arid conditions, including problems of comfort, health, buildings design and energy use. Laboratory and field work are directed towards **1.** instrumentation and measurements of climatic variables of special interest in arid environments, particularly those important to the radiation, water, and heat budgets; and **2.** statistical and other quantitative methods for summarization and interpretation of single and combined climatic elements to provide relevant information required for sound management of arid lands.

27.913G Soil Studies for Arid Lands Management **S1 or S2 L2T4 C6**

Soil forming processes in arid regions. Physical, mineralogical and chemical characteristics of arid soils, with emphasis on properties significant for land capability. Chemical and physical properties of saline and alkaline soils. Soil response to irrigation, secondary salinization and alkalization. Classifications and distribution of arid zone soils and their environmental relationships. Field methods and soils survey techniques; statistical analysis of soil data and its application to mapping. Laboratory analyses of physical and chemical characteristics of soils, with emphasis on properties significant for land capability. Based on 27.133, with additional reading, tutorials, seminars and practical classes to stress the features of arid zone soils. The formal component of the above teaching would be completed at Kensington. However, a number of tutorial and laboratory hours are devoted to a field-based soil mapping project based at Fowlers Gap Research Station.

27.914G Terrain Evaluation **S1 or S2 L2T4 C6**

Methods of defining and mapping land units for resource assessment and management. Principles of land capability classification with reference to pastoral, agricultural and irrigation land use in arid and semi-arid regions. Physical indicators of desertification and land degradation in dry regions including accelerated wind and water erosion and secondary salinization.

27.915G Project in Land Evaluation **S2 T9* C9**

Practical application of a system of land classification in an arid or semi-arid environment as a basis for land management or land-use planning, or a comparative review of existing approaches to land evaluation. Involves fieldwork, probably at Fowlers Gap Research Station, and the preparation of a report.

27.916G Research Project in Land Evaluation **F T9* C9**

As for 27.915G, but involving more substantial research over a longer period.

†Offered subject to availability of staff.

*Equivalent contact hours, but also involving fieldwork out of session.

27.917G Project in Soil Conservation

S2 T9* C9

A practical investigation of soil degradation associated with the deterioration of rangeland on Fowlers Gap Research Station, or in another part of arid or semi-arid Australia, in relation to soil-vegetation characteristics and land use. May involve investigation of techniques used in combatting soil erosion problems. Involves the preparation of a report.

27.918G Research Project in Soil Conservation

F T9* C9

As for 27.917G, but involving more substantial research over a longer period.

School of Marketing

Undergraduate Study

28.012 Marketing Systems

S1 L2T2

A conceptual introduction to marketing from the systems viewpoint. Discusses the evolution and characteristics of marketing systems, buyer behaviour, marketing channel flows (equalizing supply and demand, communication, ownership, finance, physical distribution), marketing activities in the firm (planning the marketing program, co-ordination and control of marketing activities, problem solving, product planning, promotion and pricing, physical distribution management), resources allocation by competition, the expanding role of government, social performance of marketing and social efficiency of marketing.

28.032 Behavioural Science

S1 L2T2

Prerequisite: Nil.

Major concepts and research in the behavioural sciences which reveal the dynamics of human behaviour and the variety of viewpoints that can be adopted in explaining behaviour. The nature and scope of behavioural science; culture; social institutions; groups; social class; interpersonal and mass media communication; learning; perception; personality.

28.042 Consumer Behaviour

S2 L2T2

Prerequisite: 28.032

The specific sociological and psychological topics in Behavioural Science are applied to the problem of understanding the consumer in

the marketing context. The following areas are covered: motivation and arousal; consumer behaviour as a decision process; problem recognition; search behaviour; choice behaviour; purchasing processes; post-purchase behaviour.

28.052 Marketing Research

S2 L2T2

Prerequisite: 15.421 or approved substitute.

Sources and types of marketing information. Design, conduct, analysis and reporting of market surveys, experiments. Techniques of statistical inference.

School of Surveying

Undergraduate Study

29.441 Surveying for Engineers

S1 or S2 L2T4

Coordinate Systems. Levelling. Theodolite and angular measurements. Distance measurements: steel band, electronic. Traversing. Tacheometry. Contour and detail surveys. Horizontal and vertical curves. Area and volume computations. Control surveys, engineering and underground surveys. Outline of photogrammetry.

29.491 Survey Camp

A one-week field camp for students studying 29.441 Surveying for Engineers.

Graduate Study

29.520G Photogrammetric Production Processes

SS L1½T1½ C3

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry. Digital terrain models.

*Equivalent contact hours, but also involving fieldwork out of session.

29.601G Remote Sensing Principles and Procedures S1 L2T1 and S2 L1½T1½ C6

Electromagnetic radiation. Definition and physics of basic quantities. Photographic film, images and sensors. Electro-optical sensors. Data systems. Examples of operational systems. Positioning, preprocessing, deconvolution, enhancement and classification theory and application to Landsat data. Project involving processing of Landsat data.

29.604G Land Information Systems SS L2T1 C3

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerisation of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters.

29.605G Ground Investigations for Remote Sensing C3

The spectral, temporal and spatial characteristics of various surfaces, and the available sensors to effect maximum differentiation. Ground and image comparisons. Instruments available for field measurements. Field investigation procedures including positioning and sampling considerations.

Department of Organizational Behaviour

Graduate Study

30.935G Organization Behaviour A S1 L3 C3

Develops an understanding of the individual and social factors affecting behaviour in organizations. The broad, interdependent social forces shaping contemporary Australian society, and, after society the individual. The nature of human potential, personality dynamics and motivation. Social trends and discontinuities; changing values and ideologies; theories of personality and socialization; identity, self-esteem and the formation of personality; processes of learning and unlearning; perception and emotion; motivation; personality assessment; aptitude, creativity, job satisfaction and job effectiveness.

School of Town Planning

Undergraduate Study

36.411 Town Planning S1 L2T1

Introduction to the purpose, scope and application of planning. The urban planning process. Objectives and means of planning cities. Levels of planning and types of plans. Planning law and administration. Future of cities.

Graduate Study

36.062G Urban Planning C1

Priorities in urban planning, topography, community services, industry, selective zoning and decentralization; relationships to regional planning. Cost of pollution and control measures; legal aspects; planned development; architectural aspects; density distribution. Case histories.

36.945G The Organization of Town Planning C2

Aims, means and consequences of town planning in Australia. *Aims of planning*: organization of the environment in respect of space and time, interrelationship of functions, equity of resource distribution, human satisfaction, the nature of the planning approach. *Means of planning*: overview of the planning process, laws related to planning, planning assessment procedures, environmental management at different levels, decision-making processes — financiers', firms' and private decisions, changes in public values, public participation, political and economic constraints. *Consequences of planning*: illustrative case studies, evaluation of planning methodology and procedures.

School of Landscape Architecture

Undergraduate Study

37.3015 Environmental Impact Assessment I S1 L1T1 C2

**37.3016 Environmental Impact
Assessment II**

S2 L1T1 C2

Prerequisite: 37.3015.

The environment defined in terms of bio-physical and socio-economic factors. Introduction to the general principles of environmental survey and analysis and the assessment of impact. Specific methodologies are reviewed on a comparative basis. The importance of communication between the environmental sciences and professions and the problems of objectivity.

Emphasis is upon the role that environmental impact assessment should play as part of the planning process and landscape assessment methodologies are reviewed with specific reference to their adaptability for use as a 'before and after' technique for comparatively assessing impact in relation to visual/aesthetic factors.

The student undertakes a specific study of current social significance on a group basis in two phases over two consecutive sessions, in the same year. Each phase is used as a partial assessment of progress.

**37.3347 Landscape Conservation and
Rehabilitation**

S1 L1T1 C2

The various interpretations which have been placed upon both words; the emotionalism which has clouded numerous conservation issues. Conservation as 'the rational use of the environment to achieve the highest sustainable quality of living for mankind'. Following the general examination of conservation and rehabilitation principles a number of specific examples are studied, representative of landscapes threatened or adversely affected by increasing recreational use, mineral extraction, waste disposal and industrial blight. Methods of control and rehabilitation.

37.7116 Landscape Planning

S2 L2T1 C3

Current techniques of land-use planning based upon an analysis of natural phenomena and resource data. Landscape resources and data gathering techniques followed by the manipulation of modelling of resource data, introducing the idea of landscape values, sieve processes, mathematical models, statistical methods and evaluation procedures. Various analysis and assessment techniques developed by outstanding leaders in the landscape planning arena since the early 1960s in detail, as well as a number of planning studies and the recent work of government agencies which are concerned with wise land use resource allocation, modification or conservation.

Visual analysis, assessment and evaluation techniques detailed in order to incorporate this important aspect into planning models. Computer applications, including the LANPLAN program comprises an important component of the subject.

**37.7195 Recreation Management and
Design**

S1 L2 C2

Contemporary public demand for recreation, related to the available space capable of fulfilling these requirements. Specific needs of a range of recreation activities analysed and those which conflict with the retention of public space identified. Various open space classifications — national parks, scenic areas, nature reserves, historic sites, foreshore reserves and specific purpose areas such as water catchment and forestry areas — their usage and potential. Special needs of groups such as the handicapped considered. Review of current government policy and proposals and detail study of successful Australian and overseas examples of planned recreational use.

School of Food Technology

Undergraduate Study

38.122 Man and Food

S1 L1T0

Food in history; world food production and trade; world food problems; world food agencies; food developmental programs. Food habits, attitudes and beliefs, food choice. Principles of food preservation.

38.131 Principles of Food Preservation

S1 L4

Prerequisites: 38.122, 38.421, 38.521.

Introduction to food preservation; spoilage control by traditional and modern techniques. Technology of food preservation by heat, chilling and freezing, sun drying and dehydration. Use of salt, sugar, acid, chemical preservatives, ionising radiations in food preservation. Chemical and microbial stability of foods. Packaging requirements for preserved foods. Water relations of foods. Production and storage stability of intermediate moisture foods. Water quality criteria, treatment of water. Nutritional consequences of food processing.

38.132 Plant Food Science

S1 L3

Co-requisite: 38.131.

Classification, distribution, production and trade of world plant foods. The science and technology of *Fruit and Vegetables*: genetic and environmental effects on composition and quality; biology of development, maturation and ripening; harvesting; concept of deterioration of fresh fruit and vegetables; technology of wine production; technology of juice and beverage production; chemical and sensory quality control procedures. *Cereals*: structure, composition and uses of wheat, rice, rye, corn, sorghum; wheat milling, flour properties; technology of bread, pasta, biscuit and cake manufacture; starch-gluten separations and derived products.

Plant-Derived Products. Sugars: sources, types, composition, use with other foods; sugar milling, refining; confectionery manufacture, control of spoilage. *Lipids*: sources, composition, extraction, purification processes, chemistry; processing of cooking oils, margarine, shortenings; use with other foods. *Proteins*: sources, extraction procedures, nutritional and toxicological factors, texturizing processes, use with other foods.

38.133 Animal Food Science

S2 L2

Prerequisites: 2.002A, 2.002B, 2.002D, 38.122, 38.521.

Meat: Animal resources, breeds, growth and development. Slaughter, carcass composition, post-mortem biochemistry, meat composition, structure and quality factors, meat microbiology. Cold storage, chilling, freezing, ageing, curing, drying and packaging of meat and meat products; their microbiological and biochemical implications.

Marine Products: Nature and distribution of world resources; harvesting of teleostean and elasmobranch species; spoilage reactions, their control and quality assessment. Chilling, freezing, salting, drying, smoking and fermentation of fishery products. Fish meal and fish protein concentrates.

Egg Products: Structure, composition of the avian egg, quality assessment and microbiology of intact and liquid egg products. Egg pulping, freezing and drying with reference to functional and microbiological qualities.

Milk and Dairy Products: Chemical and physical properties of milk: general composition, proteins, lipids, carbohydrates, vitamins, minerals, flavour, colour. Milk contaminants: antibiotics, pesticides, radionuclides, sanitizer residues. Milk microbiology: spoilage, public health, pasteurization. Chemistry, biochemistry, microbiology and manufacture of milk products: homogenized, dried and condensed milks, cream, butter, ice cream, cheese yoghurt.

38.134 Food Science Laboratory T6

Co-requisites: 38.131, 38.132, 38.133, 38.331, 38.431.

An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the subjects 38.131, 38.132, 38.133, 38.331 and 38.431. Includes examination and use of food processing equipment; food packaging materials; the evaluation of unit processes used in the preservation and modification of foods of plant and animal origin including fruit and vegetables, cereals, sugars, lipids, meat, fish, eggs and dairy products; their properties, uses, microbiological, chemical, biochemical and nutritional status and changes undergone during processing and storage. Includes metropolitan factory inspections and a field excursion of one week to food production, processing and research organizations in Northern NSW and Queensland.

38.135 Food Quality Assessment S2 L1 T2

Food quality: Review of characteristics of food quality; review of instrumental assessment of food quality. **Sensory assessment of food:** Review of theories of sensory perception; practical aspects of sensory assessment such as experimental design, questionnaire design, laboratory design, choosing a test method; outline of test methods, their execution and results analysis; sensory interactions; consumer testing methodology; correlation of subjective and objective methods; case studies; field studies involving evaluation of the role of sensory assessment in the Australian food industry; laboratory exercises.

38.140 Food Technology Project T8

The student undertakes 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.

38.141 Food Regulation and Control S1 L4

Prerequisites: 2.043L, 38.131, 38.132, 38.133, 38.134, 38.331.

Food legislation: State and NH&MRC food standards and mechanisms; Codex standards; case studies in food standards development; food and nutrition policy.

Process control: revision of statistics, mean, variance, test of hypotheses, sample procedures; measurement of residence time distribution curves.

Pest control: creation of pest problems; techniques of pest control; effects of control measures on environment.

Non-microbial hazards in foods: definition; types of compounds that can be found in food and their effect on man; foods in which toxicants are found; methods of inactivation.

Food additives: functions and modes of action of various classes of food additives; consequences of their use; National, State and International attitudes and standards; principles of toxicological testing and evaluation of results.

Product development: needs for new food products; role of market research, advertising and food technology in the generation of new product ideas; steps in the development of a new product; new product failure and success; practical exercises in new product development.

Microbiological quality control: good manufacturing practice; in-plant testing; microbiological sampling; sampling plans; decision criteria; microbiological criteria for foods.

38.142 Oenology S1 L2T4

Prerequisite: 38.132.

History and nature of grape wines; grape and wine statistics; concept of cultivars within *Vitis vinifera*; other *Vitis* species; vine and grape physiology and biochemistry; maturity assessment and significance; influence of climate, soil, and other factors on wine quality; harvesting procedures; oenological procedures including crushing, sulphiting, pressing and draining, fermentation procedures, maturation and storage, stabilization and clarification, bottling, packaging, and distribution; wine types and composition; quality assessment; quality control and analytical procedures; distillation and production of fortifying spirit and brandy; world wine industry, wine organizations, wine literature; social uses of alcohol.

38.143 Cereal Technology S1 L2T4

Prerequisite: 38.132.

A treatment in greater depth of the following topics dealt with in graduate and undergraduate courses: Production, storage, marketing and quality of cereal grains; current trends in these areas, technology of bread, biscuit and cake manufacture; chemical, physical and biochemical interactions in wheat flour doughs; flour milling and assessment of flour quality. Additional topics include cereal protein analysis, properties and behaviour; wheat variety identification; meat-cereal combinations; cereal enzymes; non-food uses of cereals; preparation and uses of cereal protein, starches and lipids.

38.144 Treatment and Utilization of Food Processing Wastes S2 L2T1

Prerequisite: 38.131.

Ecological effects of waste discharges into the marine environment. Purification of water for domestic and industrial applications; water reuse; process modifications for effluent reduction. Origin, composition, treatment, disposal and utilization of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants. Seminars, assignments.

38.145 Marine Products Technology S1 L2

Prerequisite: 38.133.

Fish species, quality control and operations used in fish canning, problems encountered with canned marine products. Fish farming, processing of carp and fish roe. Preparation of individual fish portions and utilization of commercially unattractive species. Harvesting, handling, processing and spoilage of molluscs and crustaceans. Utilization of unusual marine organisms. Industrial fishery products.

38.146 Inspections S2 T3

Inspection of food processing plants, growing areas and research stations in Sydney metropolitan area, New South Wales, Victoria and South Australia.

38.147 Food Quality Assessment S2 L2

Co-requisite: 38.141.

Taste panel methodology: design of questionnaires, environmental conditions, panel selection and training; case studies of several types of taste tests, including consumer surveys; correlation of objective and subjective results of particular foods; masking and synergism of flavours.

38.148 Communications in Food Science and Nutrition S1 L1T2

Prerequisites: 38.131, 38.132, 38.133, 38.134, 38.331.

Sociocultural and psychological basis of attitudes and beliefs in food nutrition and food hygiene. Educational techniques for implementing behavioural and attitudinal change at varying levels of specialization. Skills in preparation and delivery of oral and written presentation, use of instructional media, preparation of audiovisual aids. Planning and evaluation of instructional units.

38.331 Food Microbiology I S2 L2

Prerequisite: 44.143 or other equivalent introductory Microbiology course.

Food spoilage: Microbial ecology of food spoilage; specific microbial associations; taxonomy of dominant species. Biochemistry and physiology of microbial growth in foods; psychrophiles, mesophiles, thermophiles, osmophiles, halophiles; production of degradative enzymes, off-flavours, odours and slimes.

Food fermentation: Microbial fermentation of foods as a means of preservation and flavour enhancement; microbial ecology and biochemistry of food fermentations. Fermented milk, vegetable, meat and seafood products; Baker's yeast, food yeasts and yeast autolysates. Single cell protein. Microbial enzymes and polysaccharides in foods.

Food-borne microbial disease: Foods as vectors of disease and food poisoning; incidence and occurrence, infection and intoxication. Ecology and taxonomy of common food-borne pathogenic bacteria. Food-borne viral disease. Mycotoxins. Methods of enumeration and detection of common food-borne pathogenic organisms. Indicator organisms. Control and prevention of food-borne disease, standards, legislation. Food hygiene.

38.341 Food Microbiology II S2 L2T4

Prerequisite: 38.331.

A detailed theoretical and practical treatment of the ecology, taxonomy and biochemistry of bacteria, yeasts, fungi and viruses involved in food spoilage, food-borne disease and food fermentations. Emphasis on specific methodologies for the detection, enumeration and identification of food associated bacteria, yeasts and fungi. Problems of enumerating microorganisms in foods: techniques of food and surface sampling; formulation, performance and evaluation of selective-differential media; sublethal injury; the value of indicator organisms. Rapid methods for microbial enumeration and identification. Control of microorganisms in foods; microbiological quality control in food production; sanitation and disinfection; food legislation and microbiological standards.

38.344 Yeast Technology S2 L2T1

Prerequisite: 38.331.

The ecological, taxonomic and biochemical fundamentals of yeasts. The role of yeasts in alcoholic fermentations; beer, wine, cider, distilled spirits. Baker's yeast production and the role of yeasts in baking. Yeast fermented foods. The spoilage of foods by yeasts. Yeasts and yeast extracts as food for animals and humans. Yeast enzymes in the food industry.

38.421 Food Engineering I S2 L2T1

Raw materials, markets, organisation of the Australian food processing industries, food processing equipment; use of computers and automated control; dimensions, units, dimensionless groups; thermal and physical data of foods; material and energy balances. Includes appropriate factory inspections.

38.431 Food Engineering II S1 L2T1

Prerequisite: 38.421.

Food rheology, fluid flow; selection of fluid flow equipment; steady-state heat transfer; selection of insulation, heat exchangers; materials of construction for food processing equipment; measurement and control of process variables.

38.441 Food Technology (Chemical Engineering) L4T3

The science and technology of foods of plant and animal origin — fruit and vegetables, meat, fish, eggs, milk, fats and oils, cereals, sugars; their derived products with particular reference to microbiological aspects, their modification during processing and storage. Principles of food preservation with particular reference to unit processes and limiting parameters. Food spoilage, its diagnosis and control, foods in relation to disease. Food additives, food packaging. Quality characteristics of foods. Elements of human nutrition. Food regulations. Utilization and disposal of food process wastes.

38.442 Food Engineering III S1 L4T2

Prerequisites: 38.421 and 38.431.

Multiple effect and vapour recompression evaporation; vapour compression and absorption refrigeration; distillation, gas absorption, liquid-liquid and liquid-solid extraction; use of computing equipment; transient heat transfer; economic decision making; specification of equipment for filtering, mixing, concentration, refrigeration and handling of foods; laboratory work involving automatic flow control, evaporation, computer control.

38.521 Introductory Nutrition S2 L2T1

Co- or Prerequisite: 41.101 Introductory Biochemistry.

Dietary patterns. Role of nutrients in human structure and function. Nutritional needs of vulnerable groups, particularly infants, children, pregnant and lactating women, the elderly. Dietary imbalance: disorders related to the affluent diet including obesity, coronary heart disease, dental caries; problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Assessment of nutritional status; use of dietary allowances, food groups, tables of food composition.

38.541 Advanced Nutrition**S1 L2T1***Prerequisite: 38.521.*

Detailed study of the role of nutrients in human structure, function and disease, including study of micronutrients and trace minerals. Regulatory mechanisms such as appetite, control of nutrient metabolism and growth. Nutrition and infection. Alcoholism. Therapeutic nutrition and formulation of special dietary foods.

38.543 Field and Laboratory Methods in Nutrition**S2 L1T2***Co- or prerequisite: 38.541.*

Methods of nutritional assessment including anthropometry, energy expenditure, dietary intakes, biochemical assay of nutrients and metabolites in body tissues and fluids. Survey design, data processing and interpretation. Analytical methods for nutrients in foods, including advanced instrumental techniques.

Graduate Study

38.151G Introductory Food Science**S1 L2***Co- or prerequisites: 2.271G, 42.211G, 42.212G, or their equivalents.*

An introduction to the history of food preservation and human nutrition. Current world food patterns, organisations and trade. Food chemistry and the role of nutrients in human nutrition; elements of food microbiology, food hygiene and public health aspects of foods. Parameters of food quality; food choice and social behaviour; food and society.

38.152G Food Process Laboratory**S1 T6***Co-requisite: 38.154G.*

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

38.153G Food Technology Seminar**T1**

Students present material arising from literature and/or laboratory assignments and/or plant investigations in the food and related industries. Critical assessments are made of the results of research in food science and technology.

38.154G Food Technology**L6***Co-requisite: 38.151G.*

Introduction to food technology. Principles of food preservation. The science and technology of foods of plant and animal origin, their derived products, with reference to biochemical and microbiological aspects. Food spoilage, foods in relation to disease.

38.155G Dairy Technology**L1T1**

A detailed review of trends in dairy industries at the national and international levels. The microbiology and biochemistry of dairy products with particular reference to the technology of milk, butter and cheese production. The development of new dairy products, the use of dairy products in other foods. Emphasis is placed upon the use and development of new technologies in the broad areas of dairy product processing.

38.156G Oenology**S1 L2**

History of wine production, statistics and classification. Viticulture. Grape composition. Technology and biochemistry of production of table wines, sparkling wines, vermouths, sherries; quality control procedures. Legal, cultural, climatic factors in French, Spanish, Portuguese, Italian, German, Californian and Australian wine production. Principles of sensory testing and evaluation of wines.

38.157G Technology of Cereal Products**L1***Prerequisite: 38.132 or cereal strand of 38.154G.*

World production of cereals; cultivation, diseases, harvesting and storage of cereal crops. Grain morphology and components, cereal quality, quality and yield improvements by breeding. Milling of wheat, flour types, flour testing, suitability for different purposes, flour component interactions in doughs, flour bleaches and dough improvers, baking technology. The use of non-wheat flours in bread and baked goods. Pasta products and breakfast cereals. Nutritional aspects of cereals. Starch-gluten separation, starch syrups. Malting, brewing, distilling and industrial alcohol production from cereals. Preparation, properties and uses of modified starches.

38.158G Marine Products**L1***Prerequisite: 38.133 or marine strand of 38.154G.*

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

38.159G Food Process Wastes**S2L1***Prerequisite or co-requisite: 48.063G.*

Microbiological aspects of water quality and waste treatment. Water quality criteria for food processing operations. Origin, composition, treatment, disposal and utilization of food processing wastes. Plant and field inspections.

38.160G Food Quality Assessment**S2 L2**

Taste panel methodology: design of questionnaires, environmental conditions, panel selection and training; case studies of several types of taste tests, including consumer surveys; correlation of objective and subjective results of particular foods; masking and synergism of flavours.

38.161G Food Additives and Toxicology L1

Functions, modes of action of food additives, consequences of use; ethical and legislative considerations. National, State and international attitudes and standards. Principles of toxicological testing, the evaluation of results.

38.162G Postharvest Physiology and Handling of Fruit and Vegetables S2 L2T4

Biochemistry and physiology of metabolism in fresh fruit and vegetables; respiration measurements as an index of metabolism, maturation and senescence; concept of climacteric and non-climacteric produce; physiological and metabolic changes occurring during ripening. Effect of temperature on metabolism — constraints of high and low temperatures; role of humidity control and water loss in quality maintenance; use of atmosphere control to delay senescence and ripening. Physiological disorders of stored produce; microorganisms of importance to postharvest tissue; physical and chemical methods of control; postharvest disinfection and quarantine measures. Examination of current commercial storage and marketing operations.

38.163G Methods in Food and Nutrition Education S1 L1T2

Co-requisite: 38.151G.

Community food and nutrition habits, knowledge and beliefs. Programs for nutrition education; design and evaluation. Communication and educational skills including use of instructional media and preparation of audiovisual materials.

38.351G The Microbial Ecology of Foods S2 L2T4

Prerequisites: An introductory course in Microbiology, 38.154G or 38.331.

An integrated lecture and laboratory course covering the ecology, taxonomy and biochemistry of bacteria, yeasts, fungi and viruses involved in food spoilage, food-borne disease and food fermentations. Emphasis on specific methodologies for the detection, enumeration and identification of food associated bacteria, yeasts and fungi. Problems of enumerating microorganisms in foods: techniques of food sampling; formulation, performance and evaluation of selective-differential media; sublethal injury; indicator organisms. Rapid methods for microbial enumeration and identification. Control of microorganisms in foods; microbiological quality control, food legislation, microbiological standards.

38.451G Advanced Food Engineering S1 L2T1

Prerequisites: 38.421 and 38.431 or an introductory course in material and energy balances, heat transfer and fluid mechanics.

Mathematical representation using vector calculus of heat and mass transfer and fluid mechanics in foods; numerical methods of solution; thermodynamic analysis of processes; laboratory work on the thermophysical properties of foods.

38.452G Drying of Foods S2 L2T1

Prerequisite: 38.451G.

Psychrometry; water activity of foods; transport in porous media; spray drying, fluidized bed drying, freeze drying, batch and continuous drying; drying of grain in bulk silos; solar drying of fruit and vegetables.

38.551G Advanced Nutrition S2 L2T1

Prerequisite: 38.151G. *Co-requisite:* 38.154G.

Detailed treatment of the role of the nutrients in health and disease at different stages of the human life cycle. Nutritional topics of particular relevance to developing countries including population, infection, rehabilitation, productivity, education.

38.552G Methods of Nutritional Assessment and Analysis S2 L1T2

Co-requisite: 38.551G.

Nutrient assay of foods including bench and instrumental techniques. Human nutritional assessment by anthropometric, dietary and biochemical methods.

38.900G Master of Applied Science Major Project T6**38.901G Master of Applied Science Minor Project T3**

Graduate School of the Built Environment

Graduate Study

39.908G Community Noise Control S2 L1T1 C2

Introduction; sound and sound propagation; sound power, sound pressure, decibels; sound perception, psychoacoustics; loudness, annoyance, phons and dB(A); hearing conservation; acoustic measuring and analysing instruments — sound level meters, filters, analysers, recorders; sound sources; community noise assessment; the NSW Noise Control Act; practical exercises in sound recording, analysis and assessment; noise control — source noise reduction, use of barriers, enclosures, distance, sound absorbing materials; sound transmission through building elements; noise components of environmental impact statements.

School of Biochemistry

Undergraduate Study

41.101 Biochemistry S1 L4T8

Prerequisites: 17.021, 2.121 and 2.131. *Excluded:* 2.003J.

The chemical properties of amino acids, peptides and proteins, carbohydrates, nucleic acids and lipids and the biological roles of these compounds. The nature and function of enzymes. The intermediary metabolism of carbohydrates, lipids and nitrogenous compounds. The molecular mechanism of gene expression and protein synthesis. Photosynthesis. Practical work to amplify the lectures.

41.102A Biochemistry of Macromolecules S1 L3T9

Prerequisites: 41.101 and 2.002B.

Polysaccharides and glycoproteins including bacterial cell walls. Chemistry and biology of polynucleotides. Methods of amino acid and nucleic acid sequence analysis. Protein structure and synthesis. Active centres of some proteins. Sub-unit organization of proteins. Enzyme kinetics. Practical work to illustrate the lectures and to provide experience in modern biochemical techniques.

41.102B Physiological Biochemistry S2 L3T9

Prerequisites: 41.101 and 2.002B.

Electron transport and oxidative phosphorylation. Mitochondrial transport and function. Interrelationships in mammalian intermediary metabolism. Biochemical control mechanisms including hormones and allosteric interactions. Biochemistry of genetic diseases. Selected aspects of differentiation and development in higher organisms. Practical work illustrates the lectures and provides experience in modern biochemical techniques.

41.102C Plant Biochemistry S2 L2T4

Prerequisites: 41.101 and 2.002B.

The biochemistry of the major pathways characteristic of plants will be studied; topics include the energetics and carbon path of photosynthesis, glyoxylate cycle, growth hormones and regulatory phenomena, nitrogen fixation and assimilation.

Experimental work to illustrate and amplify the subject utilizes radioactive isotopes and a number of newer techniques.

41.102D Biosynthesis of Plant Metabolites S2 L2T4

Prerequisites: 41.101 and 2.002B. *Co-requisite:* 41.102C.

This unit complements 41.102C and is taken with it. Topics covered: cell wall formation and the synthesis and mobilization of reserve

materials; biosynthesis of amino acids, its regulation, and their conversion into non-protein material, eg. alkaloids and cyanogenic glycosides; aromatic ring formation and the isoprene pathway as a source of rubber, steroids, carotenes and essential oils. Flower pigments and phytoalexins will be discussed briefly.

Practical work, combined with 41.102C, illustrates and amplifies the subject and includes a wide range of the latest techniques.

41.111 Biochemical Control S2 L2T4

Prerequisite: 41.101.

The relationship between structure and function of enzymes, selected protein systems and hormones. Metabolic networks and control mechanisms. Practical work to amplify the lectures.

School of Biotechnology

Undergraduate Study

42.102A Biotechnology A S1 L2T4

Prerequisites: 41.101 and 42.101 or 44.101.

The basic principles involved in the operation of microbial processes on an industrial scale, including: the selection, maintenance and improvement of microorganisms; the influence of physical and chemical factors on the microbial environment; the control of environmental factors; the effects of operational patterns on batch and continuous flow cultivation; aeration and agitation; scale-up of microbial processes; air and media sterilization; the harvesting, purification and standardization of products. Discussion of the principles involved in microbial processes for chemical, pharmaceutical and food production, microbial waste treatment and environmental control. The laboratory component includes manipulation of microorganisms, laboratory-scale fermenter operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars.

42.102B Biotechnology B S2 L2T4

Prerequisite: 42.101.

Application of principles of biotechnology to the analysis and design of microbial processes of industrial relevance (antibiotics, microbial enzymes, single cell protein from carbohydrates and hydrocarbons, fermented foods and beverages, amino acids and vitamins, microbial

polysaccharides, activated sludge and photosynthetic processes for waste treatment, microbial leaching of low-grade minerals). Emphasis on quantitative approach: mass and heat balance calculations, kinetic and thermodynamic analysis, detailed equipment design and specification, process design and layout, process simulation, plant location, application of optimization techniques. The economics of microbial processes will be considered and comparison made with alternative modes of production or treatment. The economics of agro-industry in Australia using microbial processes. Marketing of fermentation products, clinical trials required, legal constraints, patent rights. Technical and economic feasibility studies, and a design project, are major components.

Graduate Study

42.211G Principles of Biology SS L3

The characteristics of living systems including a functional treatment of cytology, metabolism, bioenergetics; structure, function and characteristics of single and multicellular systems; growth; cell division; reproduction; heredity and evolution.

42.212G Principles of Biochemistry SS L3 C3

A condensed treatment of biochemistry comprising the following aspects: the elemental and molecular composition of living organisms; the chemistry and roles of the biological elements and molecules; the thermodynamics and enzymatic catalysis of metabolism; catabolic, anabolic, amphibolic and anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, β -oxidation and synthesis of fatty acids, deamination and decarboxylation, of amino acids, the tricarboxylic acid cycle, electron transport and oxidative phosphorylation; metabolic regulation and integration.

42.213G Biochemical Methods SS T3

A laboratory program in practical biochemistry. The basic instrumentation and methodology of the biochemist is introduced by practical exercises and demonstrations. A comprehensive treatment of the relevance and applicability of biochemical techniques is covered in tutorials.

42.214G Biotechnology SS L2T1

The selection, maintenance and genetics of industrial organisms; metabolic control of microbial synthesis; fermentation kinetics and models of growth; batch and continuous culture; problems of scale-up and fermentor design; control of the microbial environment involving computer/fermentor interactions. Industrial examples are selected from: antibiotic and enzyme production, alcoholic beverages, single cell protein (SCP), microbial waste disposal and bacterial leaching.

Tutorial/practical sessions include: problem solving, instrumentation, continuous culture techniques, and mathematical modelling and simulation of industrial processes.

School of Botany

Undergraduate Study

43.101 Introductory Genetics S2 L2T4

Prerequisites: 17.031 and 17.021.

Various aspects of molecular, organismal and population genetics, including: meiotic and non-meiotic recombination, genome variations, mutagens and mutation rates, cytoplasmic inheritance, gene function, genetic code, gene structure, collinearity of polynucleotide and polypeptide, control of gene action, genes and development, population genetics, genetics and improvement of plants and animals.

43.111 Flowering Plants S1 L2T4

Prerequisites: 17.031 and 17.021.

Plant cell structure, structure and functions of the major organs in Angiosperms (flowers, roots, stems and leaves), secondary thickening and arborescence, transport systems in plants, seeds and germination. Variation in structure and function in relation to the environment. Introduction to taxonomy and identification of major Australian plant families. A weekend field excursion forms part of the course.

43.112 Plant Taxonomy* S2 L2T4

Prerequisite: 43.111. *Co- or prerequisite:* 43.101.

Considers the assessment, analysis and presentation of data for classifying plants both at the specific and supra-specific level with emphasis on vascular plants. Field work is part of the subject.

43.121 Plant Physiology S2 L2T4

Prerequisites: 17.031 and 17.021 and any two (2) units of 2.111, 2.121, 2.131.

The physiology of the whole plant: photosynthesis, inorganic nutrition, transport, translocation, physiology of growth and development, plant growth substances and their application in agriculture.

43.142 Environmental Botany* S1 L2T4 C6

Prerequisites: 17.031 and 17.021

The soil and atmospheric environments in which plants live and the interaction of plants with their environment. Energy and mass transfer. Emphasis is placed on the role of environmental sciences in food production. Students are required to attend one week-day field excursion as part of the practical course.

*Note: 1. The subject 43.112 Plant Taxonomy, alternates with 43.162 The Plant Kingdom (43.112 will be given in 1982). 2. 43.112 Plant Taxonomy, 43.162 The Plant Kingdom and 43.142 Environmental Botany may be taken in either second or third year of the Science course provided that prerequisites have been completed.

43.152 Plant Community Ecology**S2 L2T4**

Prerequisites: 43.111 and 17.012 or 27.111.

Recognition and delimitation of plant communities. Ecology of selected Australian vegetation types. Use of numerical methods and application of community concept of palaeoecology. Field work forms an integral part of this course.

43.162 The Plant Kingdom***S2 L2T4**

Prerequisite: 43.111.

The major taxa of the Plant Kingdom with emphasis on the green plants. The evolution of basic vegetative structures, reproductive structures and genetic systems are studied. Field work is part of the subject.

microbiological methodology; bacterial anatomy and cytology: cell walls, flagella pili, nucleus, inclusions, capsules, endospores. Microbial growth: methods of measuring; growth curves; batch, continuous and synchronous cultures. Microbial nutrition and metabolism: autotrophs and heterotrophs; photosynthesis, fermentation and respiration; biosynthesis. Bacterial genetics: adaptation, mutation and mutagens; conjugation; plasmids and drug resistance factors; genetic engineering concepts. Bacterial virology; lytic phages, lysogeny, transduction, phage typing. Bacterial taxonomy, ecology and diversity, basic principles and review of the major bacterial genera and groups. Yeasts and fungi: general ecology, morphology and modes of reproduction; mycotoxins. Immunology and serology: antigens, antibodies and their interactions; applications to identification. Medical microbiology: microbes as pathogens. Applied microbiology. Microbiology of soils and waters, nitrogen fixation, industrial fermentations, alcoholic beverages, single cell protein, food microbiology.

School of Microbiology

Undergraduate Study

44.101 Introductory Microbiology**S1 L2T4**

The general nature, occurrence and importance of microorganisms. A systematic review of the major groups of microorganisms: the eucaryotic protista (microalgae, protozoa and fungi); procaryotic protista (blue-green algae, 'higher' bacteria, typical unicellular bacteria and small bacteria-like forms); plant, animal and bacterial viruses. The relationship between microorganisms and their environment; ecological considerations. Interactions between microorganisms and higher organisms.

Students wishing to enrol in this subject must obtain the written approval of the Head of the School of Microbiology. Those who can provide evidence of previous satisfactory training in biological science will be permitted to enrol immediately. In the absence of such evidence, students will be required to attend a course of lectures in Basic Cellular Biology to be presented in the first three weeks of Session 1. This course introduces the concepts of cellular biology, cell theory and cellular diversity including structure and function of cells. It also briefly describes biologically important molecules (proteins, polyaccharides and nucleic acids), enzyme catalysis and biological dynamics.

44.143 Microbiology AS**S1 L4T6**

Prerequisites: 17.031 or 17.011 and 17.021.

The history, general nature, occurrence and importance of microorganisms. General features of procaryotic and eucaryotic protista. Basic

School of Zoology

Undergraduate Study

45.121 Evolutionary Theory**S1 L3T3**

Prerequisites: 17.031 and 17.021.

Current evolutionary theory, emphasizing the population level. Ecological genetics, evolutionary aspects of ecological niche theory, speciation, evolution of social behaviour, molecular evolution, and general evolutionary genetics. Some background in genetics is desirable.

45.122 Animal Behaviour**S2 L1T4**

Prerequisites: 45.101 and (45.201 or 45.301).

An introduction to Ethology, the biological study of behaviour. Physiological, ecological, developmental and evolutionary aspects of behaviour are examined as important elements in the analysis of behaviour, particularly social behaviour. Both field and laboratory work are included.

45.152 Population and Community Ecology

S1 L2T4

Prerequisites: 17.021 and 10.001 or 10.011.

Examination of the dynamics of one, two or more interacting populations. Systems analysis and simulation in ecology. Theoretical and mathematical analysis of the dynamics and stability of ecosystems. Topics in the optimal management of renewable resources. Unifying concepts in ecology.

45.201 Invertebrate Zoology

S2 L2T4

Prerequisites: 17.031 and 17.021.

A comparative study of the major invertebrate phyla with emphasis on morphology, systematics and phylogeny. Practical work to illustrate the lecture course. Obligatory field camp.

45.301 Vertebrate Zoology

S2 L2T4

Prerequisites: 17.031 and 17.021.

A comparative study of the Chordata, with particular reference to the vertebrates, including morphology, systematics, evolution and natural history, with reference to selected aspects of physiology and reproduction. Practical work to supplement the lecture course. Field excursions as arranged.

45.302 Vertebrate Zoogeography and Evolution

S2 L2T4

Prerequisite: 45.301.

A geographic approach to the current distribution, abundance and types of vertebrate species in the Australian region. Particular emphasis is placed on the basic principles of speciation, the history of the Australian continent, vertebrate adaptations and changes in the distribution and abundance of the Australian vertebrate fauna under the influence of man. Field excursions as arranged.

Graduate Study

45.900G Ecological Studies in Arid Lands Management

S2 L2T4 C6

Prerequisite: Degree with background in bioscience or equivalent.

Collection, identification and methods of preservation of plant and animal specimens. Population statistics, plant and animal community

description. The relation of species and communities to their environment. Vegetation mapping. Controls of productivity in the arid zone. Adaptations to an arid environment. Behaviour, diet and condition of native and feral animals. Impact of native and feral animals on plant community structure and function.

Faculty of Applied Science

Graduate Study

Environmental Studies

46.200G Project

Not more than 20 credits

Research investigation on an approved topic, conducted either individually or as part of a team.

46.201G Themes in Environmental Studies

C3

Lectures and seminars on a set of themes: resource use and conservation, pollution abatement, hazard perception and adjustment.

46.203G Medical Aspects of Environmental Studies

C1

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

46.204G Legal Aspects of Environmental Studies

C1

Resources in law for the presence of satisfactory environments. Local Government, town planning, environmental, common law. History of Australian legislation — consequences in border regions. Types of legislation and machinery measures and actions thereunder. Problems of administration of available law. American experience. Economic and sociological factors.

School of Chemical Engineering and Industrial Chemistry

Undergraduate Study

General

Students are expected to possess a calculator having exponential capabilities ($\ln x$ and $\exp x$ or ' x to the y '), and this will normally be allowed to be used in examinations. However, it should be noted that calculators with very much greater capabilities than the above might not be allowed in examinations, because they could give the user an unfair advantage over other candidates. Further information may be obtained from the Head of the School.

Students of Chemical Engineering are expected to have a copy of Perry J. H. ed. *Chemical Engineers' Handbook* 5th ed. McGraw-Hill. This book is used extensively for most subjects and units. Certain subjects and units do not have specified textbooks and in these cases reference books are used or printed notes supplied.

48.001 Introduction to Chemical Industry

S2 L1T1

Introduction to the processing industry. Application of material and simple energy balances in chemical process operations. Information retrieval.

48.021 Chemical Engineering IA

Unit 1 Flow of fluids

S1 L1T1

Prerequisite: 10.001.

Introduction and units. Definitions and properties. Statics pressure distribution and measurements. Dynamics. Euler and Bernoulli equations. Momentum equations. Laminar and turbulent flow. Steady flow in pipes and equipment. Pressure losses. Flow metering. Elementary boundary layer theory. Boundary layers in pipes and on flat plates.

Unit 2 Material and Energy Balances

S1 L1T1

Prerequisite: 48.001.

A revision and extension of material and energy balance calculations with more complex examples, including those arising from stagewise operation of extraction equipment. Graphical solution of multi-stage calculations.

Students not having taken 48.001 will be required to complete a 14 hour bridging course offered by the School early in Session 1.

Unit 3 Dimensions and Dimensional Analysis

S1 L $\frac{1}{2}$ T $\frac{1}{2}$

Prerequisites: 1.001 and 10.001.

Units and measures. Conversions of units and equations. Dimensions and Dimensional Analysis. Basic principles of modelling.

48.022 Chemical Engineering IB

Unit 1 Heat Transfer I

S2 L1T1

Introduction to steady state heat transfer including conduction, convection, radiation, boiling and condensation with an emphasis on problem solving. Resistance concept in heat transfer with series and parallel combinations.

Unit 2 Computations I

S2 T2

A review of the fundamentals of FORTRAN, with extension to formatting, dimensioned variables and sub-routines. Application to the solution of selected problems involving heat and mass balances, fluid flow and pumping. This course is intended to be complementary to other material in 48.021 and 48.022.

Unit 3 Pumps and Pumping

S2 L $\frac{1}{2}$ T $\frac{1}{2}$

Types of piping and fittings. Blow cases. Air lift pumps. Reciprocating pumps, centrifugal pumps and gear pumps. Blowers and compressors.

48.025 Chemical Engineering for Ceramic Engineers

Consists of Units 1 and 3 of 48.021 and Units 1 and 3 of 48.022.

48.031 Chemical Engineering IIA

Unit 1 Mass Transfer (Theory)

S1 L1T1

Prerequisites: 2.002A, 48.021.

Molecular diffusion in gases, liquids and solids and the measurement and calculation of diffusion coefficients. Diffusion at an interface — one component unidirectional diffusion and equimole counterdiffusion under steady state conditions. Mass transfer coefficients. Estimation and application of chemical and phase equilibria. Stage calculations applied to liquid/liquid, vapour/liquid and other mass transfer operations. The two film theory and the transfer unit concept in gas/liquid, vapour/liquid, and other operations.

Unit 2 Heat Transfer II (Theory)

S1 L1

Prerequisite: 48.022, Unit 1. *Co-requisite:* 10.032.

An extension of the work covered in 48.022 Unit 1, with an emphasis on the fundamentals of conduction, convection and unsteady state heat transfer.

Unit 3 Plant Layout

S1 T1

Factory Layout: Factors governing location of processing plant. Typical dispositions of process batteries, central utilities, laboratories, workshops, amenities, storage areas, effluent treatments. Distribution of electricity, steam, process and reticulated cooling water. Boiler plants and cooling towers, steam turbine versus electric motors, local versus central location of particular utilities. Provision for expansion.

Piping & Fittings: fabrication, standards, most used sizes and types. Welded, screwed and bolted connections. Common valve types; their flow and serviceability characteristics, relative costs and integrity; blinds and blanking valves. Practical assessment of pressure loss and line sizing in straight runs and simple networks involving pumps, or blowers, valves and bends.

Process Battery: Considerations of accessibility for maintenance, operator convenience and safety. Distribution of utility fluids. Methods of erecting major process units.

Unit 4 Process Engineering I S1 L1

The role of the Process Engineer. Process development, and the creation and screening of alternatives. Block diagrams and process flowsheets, presentation of material properties, mass and energy flows at various points. Preparation and critical examination of Engineering Flowsheets. Preparation of operating instructions. Process engineering (or performance) specifications for equipment items. Practice in preparation of engineering designs and drawings.

Unit 5 Surface Separation Processes S2 L1

Principles of membrane processes, reverse osmosis, ultrafiltration, dialysis and electrodialysis. Design calculations for batch and continuous operation of reverse osmosis and ultrafiltration equipment. Principles of sorption processes, such as adsorption ion exchange and molecular sieves. Design of fixed-bed sorption equipment. Principles and design of other surface separation processes such as foam and bubble fractionation.

Unit 6 Economics I S1 L1

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, optimisation. Depreciation and taxation and their effect on economic analyses. Economic design.

48.032 Chemical Engineering IIB

Unit 1 Solids Handling S2 L1

Prerequisite: 48.021 Unit 1.

Classification of granular solids and powders according to properties which affect their storage and movement. Storage in and retrieval from stacked piles, silos and hoppers: rules for their design. Feeders and their suitability to various kinds of granular solids. Mechanical conveyors and elevators; distance limitations; hoist height limitations. Rules for design of mechanical conveyors and elevators. Fluid-particle conveyors. Introduction to hydraulic and pneumatic conveyors, feeders and fluid-particle separation systems. Rules for design of simple slurry transportation and dilute phase pneumatic transportation systems. Practical and economic considerations determining choice of system.

Unit 2 Computations II S2 L1T1

Prerequisite: 10.031, 48.022 Unit 2.

Digital Computation: Introduction to Cyber control language, use of files, efficient FORTRAN programming methods. Numerical methods for solving algebraic equations, and other computer techniques. Application to the analysis and solution of selected chemical engineering problems. *Analogue computation:* An introduction to the theory and programming of analogue and computers, with application to the solution of differential equation and the simulation of dynamic systems.

Unit 3 Engineering Thermodynamics S2 L1

Prerequisite: 48.135.

Engineering applications of thermodynamics. Heat engines, refrigeration.

Unit 4 Economics II

S2 L1

Prerequisite: 48.031 Unit 6.

Cash flow from trade and investment. Investment, decision criteria. Cost of capital, debt and equity capital, interest rates and opportunity cost. Depreciation, investment allowances and taxation, working capital, liquidity. Discounted cash flow methods of evaluating and comparing alternatives. Comparison of these methods, replacement studies, market forecasts, total demand, leasing versus investment studies, market growth, competition and market share. Plant size and utilization, sizing for future development, simulation studies. Venture analysis, treatment of technological and commercial uncertainties, sensitivity analysis, quantifying risk and combining probabilities. Treatment of risk and ranking of ventures. Case studies.

Unit 5 Safety and Failure Tolerance S2 L1

Prerequisite: 48.031 Unit 4.

Safe practices. Safety equipment. Handling and storage of hazardous materials. Disaster propagation, implications for plant and storage layout. Failure modes, the 'bath-tub' curve. Reliability theory, replacement and standby equipment. Criteria for reliability. Fault tree analysis. Accident analysis. Case histories. Factory visit.

48.035 Chemical Engineering IIC

Unit 1 Mass Transfer (Design) S2 L1T½

Prerequisite: 48.031 Unit 1.

The design of equipment for absorption, distillation and liquid-liquid extraction. Selection of column type. Design of sieve and other types of plate for plate columns. Design of packed columns. Performance characteristics of plate and packed columns. Selection of equipment for liquid-liquid extraction. Design of mixer settlers and column-type extractors. Factors affecting the performance of liquid-liquid extraction equipment. Other mass transfer equipment.

Unit 2 Heat Transfer II (Design) S2 L1

Prerequisite: 48.031 Unit 2.

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

Unit 3 Process Vessels S2 L1T½

Prerequisite: 8.112.

Mechanical design and fabrication of pressure vessels. Code and legal requirements. Design of supports for vertical and horizontal cylindrical vessels. Visualisation, freehand sketching and presentation of formal drawings and specifications for pressure vessels and equipment components. Relief valves, bursting discs, venting and draining systems.

Unit 4 Fluid-particle Systems I S2 L1T1

Prerequisite: 48.021 Unit 1.

Interaction between particles and fluids: drag, terminal velocity, sedimentation. Flow through porous media; pressure gradient, filtration, fluidization, dispersion; multiphase flow, irrigated packed columns.

48.036 Chemical Engineering Laboratory I

Unit 1 and 2

S1T2 S2T2

Prerequisites: 48.021, 48.022, 2.002A.

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat transfer, mass transfer, thermodynamics and kinetics, instrumentation, process dynamics and control. The objectives of this laboratory are: to demonstrate, reinforce and extend the principles of chemical engineering which are covered in Chemical Engineering IA & B and II A-C, to introduce various laboratory techniques which are used in the experimental investigation of chemical engineering problems; to develop an interest in experimentation, and to develop a proficiency in technical report writing.

48.039 Chemical Engineering IJJ S1 or S2 L1½T1½

Structure of the Australian chemical and mineral utilization industries. Fundamentals of manufacturing processes for industrial chemicals, petrochemicals and utilization of minerals. Detailed factory inspections. Plant and process management. Statutory and ethical considerations. Mathematical modelling of processes for management purposes. Plant and process development. Chemical engineering in practice including case studies in the use of mass and energy balances, and thermodynamic and kinetic calculations to assess current process performance and to propose improvements.

48.040 Chemical Engineering Project S1 T1 S2 T11 or S1 T6 S2 T6

The design of plant for the production of chemicals and the estimation of product costs or an experimental investigation of some aspect of chemical engineering.

48.041 Chemical Engineering IIIA

Prerequisite: 48.031

Unit 1 Convective Mass Transfer

S1 L1

Models for convective mass transfer at fixed and free interfaces. Calculation of mass transfer rates at surfaces with simple geometry. Mass transfer in dispersions and in systems involving chemical reaction.

Unit 2 Simultaneous Heat & Mass Transfer

S1 L1

Psychrometry, principles of design calculations for cooling towers and for humidification-dehumidification operations. Topics selected from: drying of solids, crystallization, sublimation, molecular distillation, gaseous and thermal diffusion.

Unit 3 Multicomponent Separation

S1 L1

Prerequisites: 48.031 Unit 1, 48.135.

The separation of multicomponent systems by stagewise operations. Brief review of conventional graphical calculation methods leading to a graphical treatment of ternary distillation. Multicomponent separations using modern computer techniques. Phase equilibrium relationships for liquid-vapour and liquid-liquid systems. Azeotropes and azeotropic distillation.

Unit 4 Transport Phenomena

S1 L1

A generalised treatment of the continuum approach to momentum, energy and mass transport. Application of the conservation equations to chemical engineering problems. Discussion of the advantages and limitations of the transport approach.

48.042 Chemical Engineering IIIB

Prerequisites: 10.032, 48.163.

Unit 1 Process Dynamics II

S1 L1

Extension of material on linear systems to distributed-parameter cases. Linear frequency response. Experimental characterization of linear systems. The analysis of non-linear systems by linearization and numerical methods. The application of these techniques to particular processes and instruments.

Unit 2 Control I

S1 L1T1

Basic concepts in control, and in the behaviour of feedback systems. Stability in linear systems. Analysis and synthesis of linear systems using root-locus and frequency response techniques. Criteria for satisfactory control. Use of computer techniques in control system analysis and synthesis.

Unit 3 Optimization

S1 L1

An introduction to some of the techniques of optimization and their application to problems from the process industries. The methods covered will include single and multiple dimensional search, linear programming and dynamic programming.

48.043 Chemical Engineering IIIC

Prerequisites: 48.031, 48.032.

Unit 1 Design Workshop

S1 L1T2

Considerations of the ways and means of attempting a design project; emphasizes to students the need 1. to study the history and alternatives to the design project, and 2. to use proper design techniques for the assigned process and equipment. Students are each given a design project or some aspect of it and are expected to produce an appropriate report on their assignments

Unit 2 Industrial Pollution Control

S1 L2

Introduction, atmospheric dispersion of pollutants, source and ambient measurement and monitoring, industrial air pollution control. Water usage in the chemical industry. Pollutants and their effects. Water quality standards. Industrial options, source reduction, water reuse, effluent disposal. Performance and selection of treatment methods. Reliability of treatment methods. Economic aspects. Legislative aspects. Factory visit. Solid waste management. Noise pollution.

48.044 Chemical Engineering Laboratory II S1 T3

Prerequisites: 48.031, 48.032, 48.033, 48.036, 48.135, 48.136, 48.163.

An integrated chemical engineering laboratory at a more advanced level than the 48.036 laboratory and with an emphasis on open-ended experiments.

48.090 Industrial Experience

Students are expected to accumulate, by the end of their full-time, 12 weeks of industrial experience during recesses.

Advanced Chemical Engineering Electives

48.0451 Plant Layout II S1 or S2 L1T1

Prerequisite: 48.031 Unit 3.

Piping: Underground, trenched and above-ground piping. Piping decks. Arrangements of process plant, process and service piping in process area. Pressure, weight and expansion stresses. Simple flexural analysis to estimate terminal reactions and stresses in pipes, valves and equipment. Providing for expansion, supporting and anchoring. Expansion take-up devices and their integrity. Economic determinants. Flexural design using computer software. Grouping of components. Pressure and flow distribution in piping-pump-equipment networks. Practical guidelines to good layout. Preparation of specifications and drawings. Codes, mandates and rules of regulatory bodies. Design of vent and drainage systems; example of poor design.

Plant layout: Site and battery plant layout to suit process, piping and operational requirements. Making the best use of topography. Preparation of plot and site plans and specifications. Logic operations and critical path planning. Project engineering.

Storage: Tank farm arrangement, layout and associated pumps and piping.

Miscellaneous: Pneumatic and slurry transfer systems. Steam reticulation, trapping and condensate handling. Detailed consideration of layout and piping around particular equipment items, and preparation of associated drawings.

48.0452 Advanced Chemical and Phase Equilibria S1 or S2 L1T2

Prerequisites: 48.135.

Sources of thermodynamic data. Methods of estimating and presenting thermodynamic data. Advanced chemical and phase equilibria of application in chemical and process engineering.

48.0453 Control II S2 L1T1

Prerequisite: 48.163.

Material covered in Control 1 is applied during tutorials to selected case studies, and is illustrated by laboratory work, and by analogue and digital computation. Lecture material complements the laboratory work, and introduces selected topics such as multi-loop system control, system identification and estimation and sequencing control.

48.0454 Reactor Engineering S1 or S2 L1T1

Prerequisite: 48.136.

Differential balances with reaction, non-ideal homogenous reactors, reaction in mixing streams, rate equations for heterogenous reactions, non-catalytic fluid-solid, and fluid-fluid reactors, solid catalysed fluid reactors, examples of complex reactors.

48.0455 Fluid Particle Systems II S2 L2

Prerequisite: 48.032 Unit 1 and 48.033 Unit 4.

Lectures and demonstrations dealing with fluidized and spouted bed techniques. The history and application of fluidization. Fluidization characteristics of different materials. Regimes of fluidization particulate, aggregative, slugging to fast fluidization. Minimum fluidization and minimum bubbling velocity. Bubble phenomena: fluid mechanical description of bubbles, bubble growth and coalescence. The distributor region and gas jets. Solids movement, mixing and segregation. Entrainment of solids. Heat and mass transfer aspects. Modelling the fluidized bed as a reactor. Design and scale up considerations. *Spouted beds:* criteria for spouting, minimum spouting velocity, maximum pressure drop. Gas and solids motion in the spouted bed. Design aspects and applications.

48.0456 Process Engineering II S1 or S2 L1T1

Prerequisites: 48.031, 48.032, 48.033, 48.043.

Process Design: Use of Computer Aided Design flowsheeting for the screening of alternatives in process design. Discussion of matrix methods for representing process topology and for use in calculation of processes with recycle.

Process synthesis with particular reference to separation process sequences and heat exchanger networks.

Fault Detection and Correction: Detection, location and identification of malfunctions in a simulated chemical plant. Selection of most appropriate remedies. Studies of repair and maintenance practices; onstream corrections versus those requiring process shut-down. Temporary and permanent corrections. Exercises in fault analysis and correction using cases from practice.

Equipment: Detailed chemical engineering design of selected equipment items.

48.0457 Oil and Gas Processing S1 or S2 L2

Prerequisites: 48.311, 48.031, 48.135.

Sources of data on hydrocarbon properties. Process design applied to gas and oil treatment plants, pipelines and storage. The petroleum refinery. Applications of chemical engineering principles to refinery processes. Products blending. Refinery economics. Optimization of refinery operations. Design and operation of refinery equipment.

48.0461 Introductory Reservoir Engineering S1 L2

Prerequisites: 48.311, 48.031, 48.135.

Origin of petroleum, rock properties, fluid distribution in reservoirs, phase behaviour of hydrocarbons, material balance equations, analysis of reservoirs: gas reservoirs; gas condensate reservoirs; solution gas drive reservoirs; water drive reservoirs.

48.0462 Advanced Reservoir Engineering S2 L2

Prerequisite: 48.0461.

Application of potential flow equations, multi-phase flow through porous media, fluid displacement, recovery efficiency, well testing. Well productivity, maximum efficient rate of withdrawal. Numerical techniques for reservoir simulation, new recovery methods.

48.113 Chemistry of Industrial Processes F L1T2

Prerequisite: 2.002A. *Co- or prerequisites:* 2.002B, 2.042C.

A study of the production of inorganic industrial chemicals from the standpoint of the application of the basic principles of inorganic and physical chemistry (acid industries, alkali industries, industrial gases, electric furnace products, superphosphates, aluminium and glass); a study of some sections of the organic industrial chemical industry — cellulose, industrial alcohols, formaldehyde, phenol, urea, phenolic and urea resins, acetic acid, polymers based on ethylene and acetylene, elastomers.

Laboratory: Students are required to attend lectures on Report Writing, carry out laboratory assignments and attend factory inspections at local and country centres as required.

48.114 Processes S2 L2

Prerequisite: 48.113.

Topics selected from the following are studied in depth: refractories, high-temperature processes, high pressure processes (especially ammonia synthesis — thermodynamics and equipment), nuclear metals, industrial polymers, fermentation industries (for details see 42.114 Fermentation Processes), applied electrochemistry, applications of thermodynamics to gas/solid and aqueous systems concerned with the processing of inorganic materials.

48.121 Corrosion in the Chemical Industry S2 L2

Chemical and electrical aspects of corrosion and their application to corrosion problems encountered in the chemical process industries. Selection of materials for chemical plant. Design factors for corrosion prevention. Methods of corrosion prevention.

48.122 Instrumental Analysis S2 L1½T4½

Prerequisites: 1.001, 2.121, 2.131.

Basic principles of volumetric and gravimetric analysis and the application of spectrometric and selected techniques to the analysis of process streams and quality control.

48.124 Applied Kinetics S1 L2T1

Prerequisite: 48.135.

The defect solid state; solid-state diffusion; heterogeneous catalysis and heterogeneous kinetics; continuous stirred tank reactors; semibatch reactors; tubular reactors; fixed bed catalytic reactors; optimization, scale-up of reactors; residence time distributions.

48.125 Industrial Chemistry IA S1 L2T3

Comprises 48.021 Units 1 and 2.

48.126 Industrial Chemistry IB S2 L2T2

Comprises 48.022 Units 1 and 2.

48.134 Applied Thermodynamics S1 L1T1

Prerequisites: 48.153.

Calculation of thermodynamic properties, statistical methods for calculation of thermodynamic properties of gases from spectroscopic data, thermodynamics of non-ideal solutions, polymers and the glassy state, changing standard states. A study of heterogeneous equilibria in multi-component systems with particular emphasis on systems of practical importance.

48.135 Thermodynamics S1 L2T1

Review of first law of thermodynamics; thermochemistry; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homogeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium.

48.136 Reactor Design I S2 L3

Introduction to reactor design — ideal batch, steady state mixed flow; steady state plug flow, size comparisons of ideal reactors, optimization of operating conditions. Multiple reactor systems; reactors in series and parallel, mixed flow reactors of different sizes in series, recycle reactor, autocatalytic reactions. Multiple reactions; reactor design for reaction in parallel and reactions in series, series-parallel reactions. Temperature effects; heat of reaction, equilibrium constants, optimum temperature progression, adiabatic and non-adiabatic operation, product distribution and temperature. Kinetics of rate processes. Significance of the rate laws and models for distributed and lumped parameter systems. Experimental measurement and correlation of process rates.

48.137 Industrial Chemistry IIA S1 L2T1

Selected aspects of unit operations for industrial chemistry students such as distillation, liquid-liquid extraction, gas absorption, filtration, evaporation and crystallization.

48.138 Industrial Chemistry IIB S2 L2T1

Consists of Computations II, normally given to chemical engineering students in 48.032, and a course on chemical kinetics to complement material given in 48.136.

48.139 Experimental Design S2 L1T1

Design of experiments, correlation and regression, quality control. Use of graphical methods, fitting empirical equations to experimental data. Preparation of nomograms using constructional determinants.

48.143 Introduction to Analog Computation

Eight two-hour periods devoted to lectures, demonstrations and laboratory exercises.

Analog computation, theory and application of analog computing elements, analog computer programming, solution of linear differential equations with constant coefficients, equation ordering and the elementary principles of modelling, illustration by examples.

48.153 Material and Energy Balances S1 L1T2

Prerequisites: 2.002A, 10.031, 48.132.

Units, material balances, gases, vapours and liquids, energy balances, combined energy and material balances, unsteady-state material and energy balances.

48.154 Process Simulation S1 L2T1 S2T1

Prerequisites: 48.111, 48.113, 48.123, 48.133, 48.153, 48.163.

The application of the hybrid computer to the study of the dynamics of processes encountered in the chemical industry.

48.163 Instrumentation and Process Control I S2 L2T1

Prerequisites: 10.031, 48.122 or 2.002D. *Co- or prerequisite:* 48.113.

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. *Instrumentation:* theory and application of transducers and transmitters for measurement of process variables. *Process Dynamics:* behaviour of linear, lumped parameter dynamics systems; first, second and higher order and integrating systems. *Process Control:* closed loop, block diagrams, controllers and controller tuning.

48.164 Instrumentation and Process Control II S1 L2T3

Prerequisite: 48.163.

Analog computation: programming techniques, representation of non-linear phenomena, application to non-linear differential equations. Process dynamics: first order processes, response of single and multiple first-order systems to a variety of forcing functions, second and higher order processes, state variable presentation of processes, the complex plane, frequency response of linear systems, identification of ill-defined processes from analysis of indicial response data. Dynamics of closed-loop systems: closed loop transfer functions, derivation of characteristic equation, performance criteria, non-linear and linear controllers, transient response of linear control systems.

Analysis and design of simple control systems: root locus method. Naslin's Method.

48.171 Chemistry of High Temperature Materials S2 L2

Chemical aspects of high temperature materials; thermodynamics and kinetics of reactions in the solid state; phase equilibria in condensed systems; gas-solid and liquid-solid reactions.

48.172 Instrumental Analysis II S1 L1T2

Theory and application of: high performance liquid chromatography, G.C./mass spectroscopy, non-dispersive infra-red spectroscopy and particle size analysis. The case of continuous analysis. The interfacing of analytical instruments to computers. On-line sampling techniques, with particular reference to chromatographic analyses. Water quality analysis.

48.174 Seminars F T3

Co- or prerequisite: 48.184.

Students are required to deliver two lecturettes on selected topics, one related to some aspect of chemical technology, and the other to their research project. The intention is to develop skill in oral expression, as well as ability in critical evaluation and logical presentation. Opportunity is taken, where appropriate, to arrange for guest lecturers.

48.184 Process Analysis F T2

Prerequisites: 48.113, 48.133, 48.163. *Co- or prerequisites:* 48.124, 48.134.

An assignment on the integrated design of process flow diagrams involving specification of basic chemical reactions and physico-chemical parameters, selection of types of equipment required, statement of variables to be measured for the control of raw materials, process conditions and final product, and the preparation of a process model suitable for automatic control.

48.194 Project (Industrial Chemistry) S1 T6 S2 T8

An experimental or technical investigation related to some aspect of industrial chemistry. Prerequisites and/or co-requisites will be determined depending on the nature of the project.

Servicing Subjects

48.023 Chemical Engineering Science I

48.024 Chemical Engineering Principles I

48.037 Chemical Engineering Science II

48.038 Chemical Engineering Principles II

48.101 Computation and Modelling in Applied Chemistry

48.412 Polymer Materials

Department of Biological Process Engineering

48.211 Biological Process Engineering F L2T4

Prerequisite: 44.101.

Structure of Metabolism: Growth of an undifferentiated organism as a physico-chemical process leading to quantification of growth processes. Structure and function of a single cell. The structure of metabolic processes. Energy metabolism balances. Small metabolite production. Macro-molecule production. Co-ordination and control of cellular processes.

Industrial Bio-processes: A review of bio-process industries. The selection, screening and maintenance of commercial cultures. The optimisation of bio-processes. Batch and continuous fermentations. Enzyme engineering, single cell protein. Biodeterioration and microbiological stability. Sanitation. Fermentation practice.

Microbial Dynamics and Energetics: Principles used in the quantification of complex systems. Quantification of biomass and the growth process. Balanced growth. The Monod model and further extensions of the model. Uncoupling of growth processes. Quantification of product formation. Distributed, segregated, unstructured and structured models. Stochastic models. Overall energetics of growth processes. Entropy and free energy relationships in complex reaction sequences. Principles and requirements of driven reactions. The energetics of cell processes and the prediction of yields and metabolic heat evolution.

48.240 Biological Process Engineering Project S1 T1 S2 T11

Project in Biological Process Engineering for students in Chemical Engineering.

Department of Fuel Technology

48.301 Fuel Engineering (for Mining Engineers) F L2T1

An elective introductory subject in fuels and energy for Mining Engineering students based on the subject 48.311 Fuel Engineering I, supplemented by appropriate laboratory experiments (consisting of 28 lectures and 14 hours of laboratory classes per session, taught over two sessions).

48.302 Fuels and Energy

S2 L2T2

A servicing subject for students in Electrical Engineering which deals with sources and properties of fuels (with particular emphasis on coal, crude oil and natural gas), principles of combustion including combustion calculations and the technology of boilers and other fuel plant. A variety of alternative energy sources and review of the national and global energy situation.

48.311 Fuel Engineering I

Prerequisites: 1.001 or 1.011, 2.121, 2.131 or 2.141, 5.010, 5.030, 10.001 or 10.011.

Unit 1 Fuels and Energy. Sources and Properties

S1 or S2 L1

Fossil Fuels: coal, oil, gas; origin, occurrence in Australia; storage, sampling and analysis; properties and their significance; classification. Other energy sources; nuclear, solar, wind, water, etc.

Unit 2 Energy Conversion

S1 or S2 L1

Principles of combustion of solid, liquid and gaseous fuels. Limits of inflammability, burning velocity, ignition temperature. Design principles of burners, combustion efficiency, excess air, air supply.

Unit 3 Fuel Processing

S1 or S2 L1

Crude oil, refinery flow patterns. General methods of gas making. Carbonization and the production of metallurgical coke.

Unit 4 Fuel Plant Technology

S1 or S2 L1

Design principles of boilers. Boiler water conditioning. Introduction to furnaces, ovens, kilns, etc.

48.321 Fuel Engineering II

Unit 1 Combustion — Fundamentals and Science

S1 or S2 L1

Reaction mechanisms of various oxidation reactions. Combustion in internal combustion engines. Types of flames: laminar, turbulent, diffusion, aerated. Formation of carbon and NO_x in flames.

Unit 2 Principles of Gasification

S1 or S2 L1

Thermodynamics of basic reactions and calculation of equilibrium compositions. The production of fuel and synthesis gases, controlled furnace atmospheres; gas purification.

Unit 3 Radiation Heat Transfer and Engineering Applications

S1 or S2 L1

Numerical and analogue methods of problem solution in radiative heat transfer. Gas and flame radiation in combustion systems (non-luminous and luminous).

Unit 4 Measurements in Flames and Furnaces

S1 or S2 L1

Gas flow, gas analysis, solids. Measurement of temperatures of flames and surfaces. Temperature calculation, theoretical, graphical, H-T charts and their application.

Unit 5 Laboratory F T1

Analysis and characterization of solid, liquid and gaseous fuels.

48.331 Fuel Engineering III**Unit 1 Combustion Engineering S1 or S2 L1**

Droplet burning, combustion of sprays. Flame stabilization. Coal combustion, burn out. Effects of fuel impurities.

Unit 2 Furnace Design S1 or S2 L1

Furnace design for continuous or intermittent operation.

Unit 3 Fuel Plant Design S1 or S2 L1

Heat recovery plant design. Flow in furnaces. Refractories. Process steam.

Unit 4 Fuel Conservation and Efficiency S1 or S2 T1

A case history and investigative approach to energy saving in industrial, commercial and domestic applications.

Unit 5 Liquid Fuels S1 or S2 L1

Constitution of mineral oils. Classification. Specifications. Correlation of properties. Properties of liquid fuels from petroleum and from synthesis, hydrogenation and pyrolysis of coal.

Unit 6 Coal and its Evaluation S1 or S2 L1

Constitution, classification and evaluation of coals. Carbonization: blending, additives, plastic behaviour.

Unit 7 Laboratory F T3**48.340 Fuel Engineering Project S1 T1 S2 T11**

Projects selected involving the design of fuel plant or experimental aspects of fuel science and/or fuel processing and utilization.

weight-, viscosity- and z-average weights. Molecular weight distribution. Thermodynamics of polymer solutions, theta solvent. Measurement of molecular weight. Fractionation methods. Conformation of a polymer chain. The crystalline state. The amorphous state. Stress/strain behaviour. Creep. Impact. Rubber elasticity. Dynamic mechanical properties. Principles of operation of polymer processing equipment; safety procedures. Polymer compound design.

48.414 Polymer Chemistry S2 L1

Prerequisite: 48.403.

Inorganic polymers, polymers for high temperature service, the use of modern instrumental methods for establishing composition and structure of high polymers.

48.424 Physical Chemistry of Polymers II S2 L1

Prerequisite: 48.403.

Selected topics from basic texts and the original literature, covering anionic polymerization, polymer degradation, polymer rheology, polymer, visco-elasticity, fracture and environmental stress cracking, polyelectrolytes.

48.434 Polymer Physics II S2 L2

Prerequisite: 48.403.

Rubber elasticity, extrusion plastometry, rheological aspects of polymer processing operations.

48.441 Statistical Techniques S1 L1T1

Prerequisite: 10.301.

The application in the Polymer industry of the z test, t test, χ^2 squared test and F test, correlation of one and two variables, single factor and two factor analysis of variance.

Graduate Study

General

48.063G Industrial Water and Wastewater Engineering

Environmental consequences of water pollution. Water quality criteria and regulations related to industrial use and disposal. Water sources and requirements of industry. Theoretical and practical aspects of treatment methods, including screening, sedimentation, oil separation, coagulation and flocculation, filtration, biological treatment, adsorption, ion exchange, membrane processes. Strategies for industry including waste surveys, prevention at source, correction before discharge water reuse. Economic aspects. Seminars. Factory visits/laboratory.

48.064G Medical Aspects

Aspects of medicine bearing upon physiological consequences of pollutants. Synergism and antagonisms; photosynthesis and phyto

Department of Polymer Science

48.403 Polymer Science S1 or S2 L2T1

Prerequisites: 2.002A, 2.002B, 10.031, 10.301. *Co- or prerequisites:* 48.001, 48.113.

Polymerization processes; stepgrowth and chain growth (free radical and ionic), stereospecific catalysts. Methods of polymerization: bulk suspension, emulsion, solution, high pressure. Industrial examples. Principles of analysis of polymers using chemical and instrumental methods. Molecular weight applied to macromolecules: number-,

toxicity, metabolic mechanisms; morbidity and mortality surveys; exposure indices. Particular pollutants: aldehydes, nitro-olefins, carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrocarbons, ozone and oxidants, particulates, carcinogens.

48.066G Legislative Aspects

Resources in law for the preservation of satisfactory environments. Local government, town planning, environmental, common law. History of Australian legislation — consequences in border regions. Types of legislation and machinery measures and actions thereunder. Problems of administration of available law. American experience. Economic and sociological factors.

48.070G Process Principles

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

48.071G Corrosion Technology I

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

Types of Corrosion: Direct chemical, galvanic, crevice, pitting, intergranular, phase attack, erosion — cavitation, stress, fatigue, hydrogen, fretting, atmospheric oxidation, high temperature oxidation. *Materials* — non-metallic: Plastics: thermoplastic — cellulose, acrylics, nylons, polyethylenes, vinyls, polypropylene, polystyrenes, fluorocarbons, chlorinated polyether. Thermosetting — phenolics, epoxies, polyesters, silicones, ureas, laminates. Laminates: reinforced plastics — fibreglass. Foamed Plastics. Rubbers: natural, synthetic — butyl, buna-S, neoprene, nitrile, ABS, silicone. Glasses: bulk — borosilicate, fused silica, glass linings. *Ceramics*: acid resisting bricks, stoneware, porcelain, concrete. *Carbon and graphite*. *Woods*.

Principles of Design for Corrosion Prevention. *Environmental Factors*: Galvanic effects — potential differences, concentration cells, anode/cathode/areas operating anodic and cathodic reactions polarization, passivity ionic conducting electrolyte. Oxygen, velocity, temperature, atmospheric contaminants, partial immersion, geometry of design, fabrication and erection. *Intrinsic Factors*: Material structure, heat treatment, surface finish. *Corrosion Testing*: Aims, specimens, surface preparation, measurements, exposure techniques, duration, aeration, temperature, expression of results — units, interpretation of results, standard tests.

48.072G Corrosion Laboratory

Laboratory assignments to illustrate and measure the mechanism of corrosion. Electroplating/anodising experiments.

48.073G Corrosion Materials

Metallic — types available, properties and applications for each of the following: cast irons, alloy cast irons, carbon steels, low alloy steels, stainless steel, special alloys. The following metals and their alloys:

aluminium, copper, nickel, titanium, lead, zinc, magnesium, tin, cadmium, chromium, cobalt. Refractory metals — molybdenum, tantalum, tungsten, zirconium. Noble metals — gold, platinum, silver.

48.074G Corrosion Technology II

Corrosion in: *Special equipment and structures*, piping, tanks, heat exchangers. *Special Environments* — corrosion by sea water, soils, fresh water, steam, atmosphere, lubricants and packings, mineral acids, organic acids, alkalis, petroleum industry, biological means, liquid metals. *Surface Preparation and Coatings*. General Theory — surface preparation — acid cleaners, alkali cleaners, solvent cleaners, mechanical cleaning, equipment. Coatings — types, properties and applications, pre-treatments, primers based on acrylics, alkyd, bitumen, epoxy, chlorinated rubber, metals, phenolic polyurethane, vinyls. Temporary corrosion — preventive. Heat resistant, electroplated metal sprayed. Wrappings.

48.075G Corrosion Seminar

Joint University/Industry colloquia on theory and practice of corrosion technology. Students present material arising from literature and/or laboratory assignments and industrialists are invited to contribute papers and/or participate in the colloquia.

48.076G Corrosion Literature Review

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

48.077G Testing Laboratory

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

48.081G Advanced Process Dynamics

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

48.082G Process Optimization

Multivariable analytical and numerical optimization in free and constrained parameter space. Optimization of functions of a continuous variable. Dynamic programming. Applications of these techniques to specific chemical engineering problems.

48.083G Equilibrium Concepts in Water Systems

The application and limitations of chemical thermodynamics in water systems. Aqueous inorganic process systems including water treatment and minerals processing. The effects and control of pollution. Thermodynamic diagrams such as $\ln E/pH$, potential/ pH , temperature/ pH and concentration/ pH are developed as an aid to assessing system energetics.

Sources and estimation of thermodynamic data. Kinetics and mechanism in relation to aqueous system energetics. Analysis of kinetic data.

48.084G System Simulation and Control

This is a participatory course in which case studies, discussions of recent papers, development of digital simulation programs and analog computer laboratory work play an important part.

Topics are selected from the following areas:

Unit 1 System Simulation

Numerical methods for digital simulation; programming languages and packages for system modelling of distributed parameter systems; use of analog computers in system simulation.

Application of these techniques to the study of process plant and equipment, environmental systems, and similar areas.

Unit 2 Advanced Process Control

System identification and parameter estimation; control of multi-loop systems; non-linear systems; digital control and data-logging, sequencing control.

48.085G Interphase Mass Transfer

Advanced theories of mass transfer. The effect of interfacial instability and methods for predicting its presence. Theoretical prediction of mass transfer in dispersed systems. Multicomponent mass transfer.

48.086G Fluid Particle Interactions

Fundamentals. Particle drag in an infinite laminar fluid, effect of turbulence and acceleration. Drag and rotation in shear flow. Multiparticle systems with homo- and heterogeneously sized particles. Co-current systems. Limiting particle transport velocity, instabilities, various criteria. Transport line feed systems, transport line driers and reactor. Design of co-current fluid-particle systems. Gas-fluidized beds. Gross behaviour, bubblephase theories, instability theories, grid-bed geometry and resistance relationships, elutriation, residence-time and size-distribution studies. Heat and mass transfer: design of catalytic and non-catalytic fluidized reactors.

48.087G Design of Process Envelopes

Theoretical treatments concerning stress analyses with time and temperature as variables, stresses at discontinuities and transitions in vessel geometry. Theories and modes of material behaviour, gas solubility effect, design of insulation, reinforcement, etc. Analyses of stresses and reactions in piping subject to large temperature changes. Code requirements. Practical aspects will include a treatment of high pressure components, eg. valves, fittings, pumps, safety devices. Economic aspects.

48.089G Graduate Colloquia

Colloquia on research developments in Chemical Engineering. Students are required to participate actively in the colloquia and give at least one dissertation based on their own investigations.

48.090G Specialist Lectures

48.091G Advanced Thermodynamics

Equilibrium: liquid-liquid, liquid-solid and liquid-vapour phase equilibria for high pressure and multicomponent system; chemical reaction equilibrium for complex systems. *Molecular theory and statistical thermodynamics:* partition functions, monatomic and diatomic gases; Chapman-Enskog theory, evaluation of thermodynamic potentials and virial coefficients; *Compressible flow:* flow of compressible fluids in ducts including supersonic flow, shock waves and stagnation properties.

48.092G Computer-aided Design

A workshop type of course with considerable time devoted to discussion, seminars, writing and running of programs. *Programming:* methods, conventions, and standards; program design, flow-charting, co-ordination and documentation. *Design:* individual plant units and components, flowsheets, optimization and economic analysis. Physical property estimation. *Simulation:* continuous change and discrete change systems.

48.110G Process Evaluation

F L1T2

Critical scientific and economic evaluation of industrial chemistry processes and research and development procedures. Process methodology, physico-chemical data and their implications, equipment and control parameters. Novel and controversial chemical processes relevant to the Australian chemical industry.

48.120G Machine Computation in Chemical Technology

S1 or S2 L2T4

Applied numerical methods for solution of industrial chemistry problems; statistical methods including non-linear and multiple regression; model discrimination and experimental design methods; plant tests and product quality control experiments; numerical optimization techniques.

48.130G Chemical Reactor Analysis and Control

S1 or S2 L2T4

Concepts of heat and mass transfer; analysis of fixed-bed catalytic reactors; fluidized beds and catalytic risers; residence time distributions; maximum mixedness and segregated flow; multiple steady states; control of tubular and stirred tank reactors.

48.131G Catalysts and Applied Reaction Kinetics

S1 or S2 L2T4

Methods of catalyst preparation and characterization; adsorption theories; general mechanisms for gas-phase reactions catalyzed by solids; poisoning and catalyst decay; effectiveness factors; techniques in catalytic research; special topics in reaction kinetics including gas-solid non-catalytic reactions, polymer kinetics, electrochemical reaction kinetics and electrocatalysis; industrial catalytic processes; application of statistical methods to the solution of complex chemical data.

**48.140G Chemical Process
Simulation**

S1 or S2 L2T4

The simulation of chemical process models using analog and digital computers. Analog and digital computer simulation techniques. The role and application of hybrid computers to the chemical industry, including simulation techniques. Optimization of chemical reactions by simulation. The economics of simulation. Practical simulation studies of selected industrial chemical processes.

**48.141G Modelling in
Chemical Technology**

S1 or S2 L2T4

Basics of modelling methods and their relationship to chemical industry.

The modelling of dynamics physico-chemical processes common to the chemical industry including the systems and subsystems approach; continuous- and discrete-time physical process models; lumped- and distributed-parameter models; evolution of models from fundamental physico-chemical principles. Approximation methods for complex and ill-defined chemical processes. Integrated chemical process models.

48.142G Chemical Process Control

S1 or S2 L2T4

Data acquisition from chemical instrumentation and its application to the control of chemical processes. Modern control techniques in the chemical industry including non-linear control, linear digital control, multivariable process control systems, and optimal control.

48.150G Instrumental Analysis for Industry

F L1T2

Role of analysis in process optimization. Accuracies of analytical methods compared to needs for quality control. Frequency of analysis in relationship to control and analytical costs. Importance of speed of analysis for information feed-back. Case studies for selected processes in relation to selecting the analytical method.

48.160G Industrial Electrochemistry

S1 or S2 L2T4

Fundamentals of electrodes, the Butler-Volmer equation, current/potential laws in relationship to reaction mechanism. Electrocatalysis, gas evolution and co-deposition. Technological aspects of electrochemistry; energy conversion systems, storage systems and plating. Industrial processes — cell design and side reactions, gas bubble effect, current distribution and mass transfer effects. Developments in electrode technology, diaphragms and cell construction. Automation and control for optimum conditions.

**48.161G Electrochemical Techniques
for Control and Analysis**

S1 or S2 L2T4

In-depth study of selected electroanalytical methods with respect to theoretical principles, instrumentation and practical utilization. The importance of adsorption and reaction mechanism on accuracies and application. Steady state and rapid scan voltammetry, stripping voltammetry, chronopotentiometry, chronocoulometry, classical coulometry and potentiometry. Instrument design and modification for specific needs.

Department of Biological Process Engineering

General

Units are offered separately subject to specified prerequisites as well as the restrictions on those units designed as bridging materials.

48.281G Design of Microbial Reactors

Unit 1 Rate Processes

Bridging unit designed to provide the background in rate processes in heterogenous systems required for Unit 3. This unit could not be offered to a graduate with background in advanced rates processes, the equivalent of 48.0454 Reactor Engineering.

Process rates and rates of change; generalized definition of a process rate. Material balances with reaction — integral balances and balanced differential with respect to time, space, and both time and space. Measurement, interpretation and correlation of process rates. Heterogeneous systems, the influence of diffusional processes, linear and non-linear systems, lumped and distributed systems.

Unit 2 Fundamentals of Microbial Stoichiometry

This is a bridging unit offered to students with little or no background in the life sciences. A prerequisite or co-requisite would be 44.101 Introductory Microbiology or its equivalent. The unit is designed to provide an understanding of the structure of metabolism to allow the student to carry out the overall metabolic balances necessary for quantification of living systems.

Growth of an undifferentiated organism as a physico-chemical process leading to quantification of the growth processes. Overall structure of metabolic processes. Material, energy and redox balances under anaerobic and aerobic conditions. Specific metabolic rates and their quantification.

Unit 3 Design of Microbial Reactors

This unit would normally follow rate processes or fundamentals of microbial stoichiometry and is divided into two strands.

Reactor Design Fundamentals: Ideal and non-ideal reactors, residence time distribution and non-ideal reactor models. The significance of mixing and diffusion in microbial reactors for freely suspended microorganisms. The concept of a microfluid and a macrofluid and its application to the description of two-phase reacting systems — gas-liquid, oil-aqueous and solid-fluid systems will be examined with examples relevant to the biological process industries.

Microbial Reactor Calculations: The collection, quantification and interpretation of rate data, and the design of reactors for freely suspended microorganisms; batch, semi-batch and continuous reactors; gas exchange balances. Rate processes in microbial flocs and microbial films. Design for microbial floc and film reactors.

48.282G Microbial Kinetics and Energetics

Unit 1 Microbial Kinetics

Prerequisite or co-requisite: 48.281G Unit 2 or equivalent.

Principles used in the quantification of complex systems. The quantification of biomass and the growth processes. A mechanistic approach to the quantification of microbial processes. The Monod model. Extension of the Monod model. Metabolic uncoupling. Inhibition kinetics and reactor stability. Factors affecting the substrate unlimited growth rate. The integration of metabolic control into an overall response.

Unit 2 Microbial Energetics

Prerequisite or co-requisite: 48.281G Unit 2 or equivalent.

Significance of entropy and free energy changes in microbial growth. Driven reactions, group transfer potentials, driven reaction sequences and the significance of actual and standard free energy changes in open systems. Application to metabolism, energy requiring pathways, energy producing pathways. Thermodynamic efficiency of growth. Mass, heat and entropy balances in growing cultures, prediction of yield.

48.283G Bioprocess Unit Operations and Equipment Design

Prerequisite or co-requisite: 48.284G or equivalent.

Engineering design and operating characteristics of plant and processes normally used eg sterilization and air purification, dehydration drying at reduced pressure, reduced temperature preservation, radiation, product isolation, sedimentation, filtration, centrifugation, extraction, absorption, chromatography and ion exchange, absorption with reaction, electrophoresis and dialysis, aseptic design, materials of construction, effluent disposal.

48.284G Heat, Mass and Momentum Transport

A bridging subject designed to provide an introductory understanding of the mechanisms of transport processes. This subject could not be offered to a graduate with a background in chemical engineering principles. Mechanisms of molecular and turbulent transport. Heat, mass and momentum transport as rate processes. Boundary layer theory. Lift and drag coefficients. Introduction to non-Newtonian flow.

48.285G Bioprocess Laboratory

Practical experience in the industrial processing of biological and microbial systems. Small projects in areas of interest to the student.

Department of Fuel Technology

Note: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

48.380G Fuel Seminar

1 (SU) to be given in Session 2, compulsory in MAppSc (Fuel Engineering) degree course. Content bias to choice of G subjects.

48.381G Atmospheric Pollution and Control C4

Unit 1 (4 SU) Causes, properties, dispersion, monitoring control and legislation.

Unit 2 (4 SU) Advanced atmospheric pollution (extension for EPC, IPC courses only, Unit 1 is a prerequisite).

48.382G Fuel Constitution

Unit 1 (1 SU) Coal constitution and pyrolytic behaviour.

Unit 2 (1 SU) Constitution and classification of oils

Unit 3 (2 SU) Advanced fuel constitution

48.383G Fuel Processing

Unit 1 (2 SU) Carbonization and gasification processes

Unit 2 (1 SU) Liquid fuels from coals

Unit 3 (1 SU) Chemicals from coals

48.384G Fuel Plant Engineering

Unit 1 (1 SU) Furnace design and heat recovery

Unit 2 (1 SU) Process heat transfer and efficient use of steam

Unit 3 (2 SU) Furnaces and boiler control system

Unit 4 (2 SU) Fuel plant heat transfer

48.385G Combustion and Energy Systems

Unit 1 (1 SU) Combustion technology

Unit 2 (1 SU) Fuel impurities removal of and deposits from

Unit 3 (1 SU) Efficiency in energy utilization

Unit 4 (1 SU) Combined cycles and integrated systems

48.386G Unit Operations in Waste Management C3

Unit 1 (3 SU) The unit operations and processes associated with modern waste management practices, ie the origin, nature, characterization, handling, transportation, size reduction and storage of various waste materials; reduction at source and disposal by composting, landfill, incineration and chemical processing; recovery and re-use of marketable products. Legal aspects; case histories.

48.387G Fuel Technology Practice

Compulsory in MAppSc (Fuel) (4 SU). Content bias towards choice of G subjects.

Department of Polymer Science

48.400G Polymer Science S1 or S2 L6T4

Polymer Processes: Classification of polymers, methods of polymerization; bulk, solution, emulsion, suspension, high pressure; processes; step growth, chain growth; the chemistry and applications of polymer systems including polyesters, polyamides, phenolic condensation resins, vinyl polymers, synthetic elastomers. Natural polymers.

Mechanism and Kinetics: Step growth polymerization, kinetics, structure effects; chain growth polymerization. Free radical polymerization, chemistry and properties of free radicals and initiators; kinetics of propagation and termination reactions; co-polymerization; monomer radical structure and reactivity. Cationic and anionic polymerization; stereoregular polymers.

Polymer Characterization: Molecular weight: averages and distributions; thermodynamics of polymer solutions; theta temperature; fractionation methods; measurement of number-average molecular weight and weight-average molecular weight.

Polymer Physics: Principles of operation of conventional polymer processing equipment; safety procedures; polymer compound design; stress/strain behaviour of polymers in tension, compression, shear and flexure; elementary rheological behaviour of polymers; rubber elasticity; thermal characteristics of polymers.

48.410G Analytical Characterization of Polymers S1 or S2 L4T4

Composition of formulated polymeric material. Group reactions, specific and colour reactions. Instrumental characterization of polymers, and co-polymers and associated additives eg plasticizers, anti-oxidants, etc. by UV and IR spectrophotometry and pyrolysis gas chromatography. Analysis of films by transmission and reflectance spectrophotometric methods. Thermal analysis.

48.430G Polymer Engineering S1 or S2 L4T2

Natural and synthetic elastomers; vulcanization, theory and method. Cross-linked thermoplastics. Extrusion. Press, injection and transfer moulding. Adhesives. Heat sealing and welding. Latexes. Films. Cellular polymers. Fibre reinforced plastics. Mould design. Physical testing-standards and air conditioning; basic principles; testing machines, thermal, electrical and optical properties; accelerated ageing; preparation of standard test compounds; creep; dynamic mechanical tests; rubber in shear; abrasion; flammability. Polymer engineering applications and design data.

48.440G Polymer Physics S1 or S2 L4T2

Chain dimensions. Diffusion and viscosity. Segmental motion and the glass temperature T_g : factors affecting T_g . Crystallinity, thermodynamic and kinetic parameters. Viscoelastic behaviour of polymers; creep, Maxwell fluid and Kelvin-Voigt solid models, Boltzmann superposition principle; stress relaxation, relaxation and retardation time spectra, WLF curves; dynamic behaviour, elastic hysteresis, damping. Stress/strain behaviour in polymers. Chemical stress relaxation in elastomeric networks. Fracture mechanisms and impact strength of polymers. Kinetic theory of rubber elasticity.

48.501G Chemical Engineering in Medicine

Application of chemical engineering principles to medicine. Introductory general physiology with particular emphasis on the kidneys, lungs and liver. Design and operation of hemodialyzers, membrane oxygenators and hemoperfusion devices. Considerations to criteria for optimal short- and long-term replacement to natural organs. Modelling of patient-artificial organ interactions. Associated laboratory work where appropriate.

48.900G Major Project

A substantial project on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

48.901G Minor Project

A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

School of Sociology

Undergraduate Study

53.001 Introduction to Sociology F L2 T1

Introduction to major issues in Sociology. Two main themes: culture, society and institutions; and social inequality. Topics: social control, power, sexism, work and leisure, class distinctions. These are treated both factually and theoretically and are considered as they relate to the situation in Australia and in the developing countries.

Assessment on the basis of performance in essays, written assignments, and tutorial classes.

School of Political Science

Undergraduate Study

54.1001 Political Science I F 4CCH

Power, democratic ideas and political institutions in Australia. Introduction to the history of Western political thought.

54.2008 Public Policy Making S2 3CCH

Prerequisite: 54.1001 at credit level or better.

The problems of administering government and the problems of decision making. Models of decision making and problems in implementation. Areas of public policy in Australia, such as poverty and education.

Australian Graduate School of Management

Graduate Study

85.716G Public Policy C3

The processes by which public policies evolve and their outcomes in society. The role of the policy analyst in conceptualizing problems and developing strategies. Topics include techniques of analysing the decision-making process, specific methods of policy analysis, the relevance of political skill and bargaining in determining outcomes, and problems of policy implementation.

Financial Assistance to Students

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. Each faculty handbook contains in its **Financial Assistance to Students** section the scholarships and prizes available within that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

As well as the assistance mentioned earlier in this handbook (see **General Information: Financial Assistance to Students**) there are a number of scholarships available to students. What follows is an outline only. Full information may be obtained from Room G20, located on the Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar by 14 January each year. Please note that not all of these awards are available every year.

Donor	Value	Year/s of Tenure	Conditions
-------	-------	------------------	------------

General

Bursary Endowment Board*	\$150 pa	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding \$4000
--------------------------	----------	---	---

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060 immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Sam Cracknell Memorial	Up to \$3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need
Girls' Realm Guild	Up to \$1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need

Ceramic Engineering

Australian Ceramic Society	Up to \$600 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the first or second year of the full-time degree course in Ceramic Engineering
Australian Consolidated Industries Ltd	Up to \$600 pa		
Monier Limited	Up to \$1000 pa		
The Brick Manufacturers' Association of New South Wales	Up to \$900 pa		
The State Brickworks	Up to \$900 pa		
The Thomson Family	Up to \$1000 pa		
Wunderlich Limited	Up to \$1000 pa		

Chemical Engineering and Industrial Chemistry

Shell Refining (Australia) Pty Ltd	Up to \$800 pa	1 year renewable for the duration of the course subject to satisfactory progress	Eligibility for admission to the second year of the full-time degree course in Chemical Engineering
Dow Chemical (Australia)	Up to \$1000 pa		Permanent residence in Australia and eligibility for admission to the second year of the full-time degree course in Chemical Engineering
Australian Waste Disposal Conference Committee	Up to \$300 pa		Permanent residence in Australia and eligibility for admission to any year of the full-time degree course in Fuel Technology

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Food Technology			
Coca-Cola Export Corporation	Up to \$1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia. Not more than 22 years of age on 1 December preceding the year in which the award commences and eligibility for admission to Year 1 of the full-time degree course in Food Technology
Food Technology Association	Up to \$1000 pa		
George Weston Foods Ltd	Up to \$4000 over 4 years		
Fielder Gillespie - White Wings	Up to \$1000 pa		

Fuel Technology

Australian Waste Disposal Conference Committee	Up to \$300 pa	1 year with possibility of further extension subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to any year of the full-time degree course in Fuel Technology
--	----------------	---	--

Metallurgy

LNC Industrial Products Pty Ltd	Up to \$1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the first and second year of the full-time degree course in Metallurgy or Metallurgical Process Engineering
Sandvik Australia Pty Ltd	Up to \$1250 pa		
School of Metallurgy	Up to \$500 pa		
			Eligibility for admission to the first year of the full-time degree course in Metallurgy or Metallurgical Engineering

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Mining Engineering			
Stan Sawyer Memorial Scholarship to Coal Mining Students	Up to \$200 pa	1 year renewable for the duration of the course subject to satisfactory progress	Eligibility for admission to the third or fourth year of the full-time degree course in Mining Engineering

Textile Technology

The Australian Wool Corporation	\$2583 or \$1675 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Textile Technology
Bonds Industries Ltd	Up to \$1600 pa		
Bradmill Industries Ltd			
Fibremakers Division of ICI Australia Operations Pty Ltd	\$2500 or \$1680 pa		
Private Treaty Wool Merchants	Up to \$1500 pa		Eligibility for admission to the full-time degree course in Textile Technology
Textile Technology Staff	Not less than \$150 pa		

Wool and Pastoral Sciences

Commercial Banking Company of Sydney Limited	Up to \$1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Wool and Pastoral Sciences
National Council of Wool Selling Brokers of Australia	Up to \$1000 pa		

Graduate Scholarships

Application forms and further information are available from the Student Enquiry Counter, located in the Chancellery. Information is available on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Postgraduate Scholarships	Living allowance of \$4620 pa. Other allowances may also be paid.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates (or equivalent). Applications to Registrar by 31 October (30 November in special circumstances)
Commonwealth Postgraduate Research Awards			Applicants must be honours graduates (or equivalent) who will graduate with honours in current academic year, and who are permanent residents in Australia.
Commonwealth Postgraduate Course Awards		1-2 years; minimum duration of course	Preference is given to applicants with employment experience. Applicants must be graduates or scholars who will graduate in current academic year and who have not previously held a Commonwealth Postgraduate Award. Applications to Registrar by 30 September (in special circumstances applications will be accepted 30 November).
Australian American Educational Foundation Travel Grant*			Applicants must be graduates, senior scholars or post-doctoral Fellows. Applications close 30 September.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women.
The British Council Academic Links and Interchange Scheme†	Cost of travel to UK		Applicants must be either senior or junior academic staff. Preference will be given to activities likely to lead to further collaboration through joint research, publication, and/or teaching programs. Applications may be made at any time and should be submitted to the Registrar.
The Caltex Woman Graduate of the Year	\$5000 pa for further studies in USA, UK, Northern Europe or in special cases Australia. There are no special allowances for travel or accommodation for married graduates.	2 years	Applicants must be female graduates who have completed a University degree or diploma this year and who are Australian citizens or have resided in Australia for at least seven years. Selection is based on scholastic and literary achievements, demonstrable qualities of character, and accomplishments in cultural and/or sporting recreational activities.

*Application forms are available from: The Secretary, Department of Education, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.

†Application forms available from The British Council, PO Box 88, Edgecliff, NSW 2077.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	Applicants must be graduates who are Commonwealth citizens or British Protected Persons, and who are not older than 35 years of age. Applications close with Registrar by 1 October.
Sam Cracknell Memorial	Up to \$3000 pa		See above under Undergraduate Scholarships, General
The English-Speaking Union (NSW Branch)	\$5000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia.
Gowrie Scholarship Trust Fund	Maximum \$2000 pa in Australia, and \$2750 if tenable overseas	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War.
Harkness Fellowships of the Commonwealth Fund of New York*	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	Between 12 to 21 months	Candidates must be either: 1. Members of the Australian or a State Public Service or semi-government Authority. 2. Staff or graduate students at an Australian university. 3. Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 36 years of age. Applications close July.
Frank Knox Memorial Fellowships at Harvard University	Stipend of \$4000 pa plus tuition fees	1 year, sometimes 2 years	Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian University.
Nuffield Foundation Commonwealth Travelling Fellowships†	Living and travel allowances	1 year	Australian citizens usually between 25 and 35 who are graduates preferably with higher degrees and who have at least a year's teaching or research experience at a university. Applications close by February.

*Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, Box 3947, GPO, Sydney, NSW 2001. These must be submitted to the Registrar by 24 July.

†Applications to the Secretary, The Nuffield Foundation Australian Advisory Committee, PO Box 783, Canberra City 2601.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Rhodes Scholarship**	Approximately £4000 stg pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens, between the ages 19 and 25 who have been domiciled in Australia at least 5 years and have completed at least 2 years of an approved university course. Applications close in early September each year.
Rothmans Fellowships Award‡	\$14000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applications close early September each year.

Applied Science

Australian Pig Industry Research Committee Postgraduate Awards Australian Wool Corporation Research Scholarship in Textile Technology Australian Wool Corporation Research Scholarship in Wool and Pastoral Sciences Australian Meat Research Committee Award*	\$4620 pa plus allowances	1 year subject to satisfactory progress. Renewable annually; maximum tenure of 2 years for a Masters candidate or 3 to 4 years for a PhD degree	Applications close 31 August
			Applicants must be graduates in textile physics, textile chemistry, or textile engineering or an appropriate discipline in science or engineering
		Minimum 2 years. Maximum 3 to 4 years	Applicants must be graduates in applied science, agricultural science veterinary science Awarded for research into the beef and cattle industry leading to the award of the Masters or PhD degree. Applications close by 31 July.

*Application forms from Executive Officer, Australian Meat Research Committee, Box 4129, GPO, Sydney 2001.

**Applications to Mr H. McCredie, Secretary of the NSW Committee, University of Sydney, NSW 2006.

‡Applications to The Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.

Prizes

Undergraduate University Prizes

Prizes which are not specific to any School are listed under General. All other prizes are listed under the Faculty or Schools in which they are awarded. Information regarding the establishment of new prizes may be obtained from the Examinations Section located on the Ground Floor of the Chancellery.

Donor/Name of Prize	Value \$	Awarded for
General		
Sydney Technical College Union Award	50.00 and medal	Leadership in the development of student affairs, and academic proficiency throughout the course.
University of New South Wales Alumni Association	Statuette	Achievement for community benefit — students in their final or graduating year.

Faculties of Applied Science and Engineering

Institution of Engineers, Australia	Medal and 100.00	The most proficient final year (or last 2 years part-time) student in the Bachelor of Engineering (or Bachelor of Science (Engineering)) Degree courses offered by the following Schools: Civil Engineering Electrical Engineering and Computer Science Mechanical and Industrial Engineering Chemical Engineering and Industrial Chemistry Mining Engineering Textile Technology (Engineering option only)
-------------------------------------	---------------------	---

School of Chemical Engineering and Industrial Chemistry

Abbott Laboratories Pty Ltd	100.00	Bachelor of Engineering degree course in Chemical Engineering — Year 4
Australian Institute of Energy	50.00	Best performance in a fuel subject
The Australian Gas Light Company's in Chemical Engineering	40.00	Subject selected by Head of School
Australian Paper Manufacturers Ltd	21.00	Subject selected by Head of School
CSR Limited	50.00	Subject within the discipline of Industrial Chemistry, selected by Head of School

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value \$	Awarded for
School of Chemical Engineering and Industrial Chemistry (continued)		
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Chemical Technology Society	25.00	Bachelor of Science degree course in Industrial Chemistry
	25.00	Bachelor of Science degree course in Industrial Chemistry, Years 1 and 2 or Stages 1 to 4
Esso Australia Ltd	200.00	Best performance in Year 2 Chemical Engineering
Institution of Chemical Engineers	100.00 and medal	Best performance for the thesis in the final year, or equivalent part-time stage, of the Bachelor of Engineering degree course
Shell	100.00	General proficiency in the second year or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course.
	100.00	General proficiency in the third year or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course.
	100.00	General proficiency in the fourth year or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course.
	100.00	For a student who, in the opinion of the Head of School, has performed some meritorious activity of note either inside or outside the University.
Simon-Carves Australia	21.00	Best performance in 48.135 Thermodynamics
Stauffer Australia Limited	50.00	Subject selected by Head of School
Western Mining Corporation Ltd	150.00	Best overall performance in 48.036 Chemical Engineering Laboratory I in the Bachelor of Engineering degree course
	150.00	Best overall performance in 48.044 Chemical Engineering Laboratory II in the Bachelor of Engineering degree course

Department of Fuel Technology

Australian Institute of Energy	50.00	For a fuel subject or allied subject project
The Shell Co of Aust Ltd	100.00	Subject selected by Head of School

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value \$	Awarded for
School of Food Technology		
Wilfred B. S. Bishop	20.00	General proficiency throughout Bachelor of Science degree course in Food Technology
Cottees General Foods	100.00	38.141 Food Regulation and Control

School of Metallurgy

Alcan Australia Ltd	100.00	} Subject selected by Head of School
Austral Crane	150.00	
Australian Institute of Metals	50.00	
Australian Welding Institute	30.00 book order	
Chamber of Manufacturers of New South Wales	15.00	
The Broken Hill Proprietary Co Ltd	100.00	} Subject selected by Head of School
Eagle & Globe Steel Ltd	100.00	
The Electrolytic Refining and Smelting Co of Australia Ltd	20.00	
Western Mining Corporation Ltd	150.00	Best overall performance in Year 3 full-time (or its equivalent part-time) in the Bachelor of Engineering (or Bachelor of Science (Technology)) degree course
	150.00	Best overall performance in Year 4 full-time (or its equivalent part-time) in the Bachelor of Engineering (or Bachelor of Science (Technology)) degree course
Zinc Corp Ltd	70.00	Subject selected by Head of School

School of Mining Engineering

Joint Coal Board	100.00	Bachelor of Engineering degree course in Mining Engineering Year 2
	100.00	Bachelor of Engineering degree course in Mining Engineering Year 3
	200.00	Bachelor of Engineering degree course in Mining Engineering — general proficiency throughout course
Western Mining Corporation Ltd	150.00	Best overall performance in final year of Bachelor of Engineering degree
	150.00	General proficiency throughout the Bachelor of Engineering degree course
	150.00	Best overall performance in penultimate year of Bachelor of Engineering degree course

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value \$	Awarded for
School of Textile Technology		
J. B. Speakman	20.00	Undergraduate thesis
R. J. Webster	100.00	General proficiency throughout the Bachelor of Science degree course in Textile Technology

School of Wool and Pastoral Sciences

Bayer Sheep Dip	50.00	General proficiency — Wool and Pastoral Sciences degree course, Years 2 and 3
Parkes Wool Promotion Committee	A shield held in the School of Wool and Pastoral Sciences on which the successful student's name is engraved each year	Bachelor of Science degree course in Wool and Pastoral Sciences, Year 3
C. R. Lucock	A book or a voucher to the value of 50.00 payable to University Co-op Bookshop Limited	Meat Science
P. R. McMahon Memorial	100.00	Excellence in wool science

W. S. and L. B. Robinson University College

Mining Managers Association Broken Hill	70.00	Performance by a student who achieves second place in a complete stage of a degree course
Mining Managers Association	40.00	Three prizes: one for each best pass in any complete stage of the degree courses in, Mechanical Engineering, Mining Engineering, Science respectively
	30.00	Seven Prizes to be awarded in individual subjects selected by the Director

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value \$	Awarded for
W. S. and L. B. Robinson University College (continued)		
Western Mining Corporation Limited	150.00	Four prizes to be awarded for best performance in 7.314R Mineral Process Technology 7.313R Mineral Processing 7.214R Mine Economics and Planning 7.224R Operational Management
Broken Hill Women's Auxiliary of the Australasian Institute of Mining and Metallurgy	30.00	Awarded for meritorious performance in a complete stage of a degree course

Graduate University Prizes

School of Chemical Engineering and Industrial Chemistry

The Clean Air Society of Australia and New Zealand	100.00	48.381G Atmospheric Pollution and Control, or a subject of an equivalent nature, taken by students in graduate courses in the School of Chemical Engineering and Industrial Chemistry
---	--------	--

Faculty of Applied Science

Staff

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

Dean

Professor M. Chaikin

Chairman

Professor R. T. Fowler

Executive Officer

John David Collins, BSc PhD N.S.W., ATI

Senior Administrative Officer

Robert Frederick Starr, ASTC

Senior Project Officer

Desmond Rokfalussy, BE Bud.

Professional Officers

Badan-Singh Deol, MSc Punj'i., PhD Syd.

Endel Nomm, BA Macq., MSc N.S.W.

Electron Microscopist

Vivian Noel Edward Robinson, BSc PhD W.Aust.

Officer-in-charge, Drawing Office

Max Renner

School of Applied Geology

Professor of Geology and Head of School

Gerald James Spurgeon Govett, DSc Wales, PhD DIC Lond., FIMM

Professor of Engineering Geology

Francis Clifford Beavis, MA Cant., BSc PhD Melb., FGS

Associate Professors

Laric Villier Hawkins, MSc Syd., FGS

Frederick Charles Loughnan, BSc Syd., PhD DSc N.S.W., AMAusIMM

John Roberts, BSc N.E., PhD W.Aust.

Bryce Leslie Wood, MSc DSc Otago, MAusIMM

Senior Lecturers

Alberto Albani, DrGeolSc Florence, MSc PhD N.S.W.

Alan Norval Carter, BSc PhD Melb., MSc Adel.

Philip Richard Evans, BA Oxf., PhD Brist., FGS

Bastiaan Jan Hensen, MSc Ley., PhD A.N.U.

Michael Barry Katz, BS Mich. T.U., MSc McG., PhD Tor.

Michael John Knight, BSc PhD Melb.

Peter Cyril Rickwood, BSc Lond., PhD Cape T., CChem, FGS, MRIC

Iftikhar Rasul Qureshi, MSc Panj., PhD Glas., FGS

Lecturers

Alistair Chisholm Dunlop, BSc N.E., PhD Lond., DIC, MIMM

Geoffrey Robert Taylor, MSc Birm., PhD N.E., FGS, MIMM, AMAusIMM

Robert James Whiteley, MSc Syd.

Senior Tutor

Maren Krysko von Tryst, BSc GradDip *N.S.W.*, AMAusIMM

Tutor

Leonie Ann Campbell, BSc *W'gong.*, DipT *Kuring-gai C.A.E.*

Honorary Associate

John Ringis, BE PhD *N.S.W.*, MGSA

Senior Administrative Officer

Graham John Baldwin, BA *A.N.U.*

Professional Officers

Peter Richard Atherden, BSc *N.S.W.*, MSc *Macq.*

Frederick Ivor Roberts, BSc *N.S.W.*, PhD *W'gong.*, AMAusIMM

Senior Lecturers

Denis Barrett, MSc *Leeds*, PhD *N.S.W.*, CEng, FlntF, FAIE

Kenneth Spencer Basden, BSc PhD *N.S.W.*, ASTC, CEng, FlntF, FAIE, MIEAust, ARACI, AMAusIMM

Michael Paul Brungs, BSc PhD *N.S.W.*

John Buchanan, ME *Syd.*, PhD *N.S.W.*

Rodney Phillip Chaplin, BSc PhD *Adel.*, ARACI

Douglas Christopher Dixon, BE MEngSc *Syd.*, PhD *N.S.W.*, MIEAust

Anthony Gordon Fane, BSc PhD *Lond.*, CEng, MIChemE

Robert James Hall, BSc PhD *N.S.W.*

Peter Munro Linklater, RDA, BAgrSc *Adel.*, MAgrSc *N.Z.*, PhD *Wis.*

Barry George Madden, BSc PhD *N.S.W.*, ASTC, FIREEAust

Phillip Souter, MSc *Syd.*, ARACI

Robert Marsden Wood, BSc *Leeds*, PhD *Camb.*, CEng, FAIPet, MIChemE

David John Young, BSc PhD *Melb.*, ARACI

Lecturers

Robert Paul Burford, BSc PhD *Adel.*, FRMS, ARACI, AMTRI

Franklin Owen Howard, BE *Syd.*, CEng

Maria Skyllas Kazacos, BSc PhD *N.S.W.*, ARICIMES

Val Wolf Pinczewski, BE *N'cle. (N.S.W.)*, PhD *N.S.W.*, CEng, MIChemE

John Frank Stubington, BE *Qld.*, PhD *Camb.*, CEng, MIChemE, MAIE

Honorary Visiting Fellow

Maxwell Kenneth Shaw, MSc *Qld.*, PhD *Calif.*, FAIFST, MASM

Honorary Associate

Gregory Joseph Lynch, ASTC, FAIE, FAIP, MIDA

School of Chemical Engineering and Industrial Chemistry

Professor of Chemical Technology and Head of School

David Lawrence Trimm, BSc PhD *Exe.*, DIC *Lond.*, CEng, FRACI, MIChemE

Professor of Chemical Engineering and Director of Undergraduate Studies

Christopher Joseph Dalzell Fell, BSc *N.S.W.*, PhD *Camb.*, CEng, FIChemE, MIEAust

Professor of Chemical Engineering and Director of Graduate Studies

Robert Thomas Fowler, BSc *Wales*, PhD *Lond.*, DScEng *Syd.*, CEng, FIEAust, FIChemE, FlntF, FAIE, MIM, ARIC

Professor of Fuel Technology

Vacant

Associate Professors

Ian Dracup Doig, BSc(Eng) *Lond.*, PhD *N.S.W.*, CEng, MIMechE, MIChemE

John Kingsford Haken, MSc PhD *N.S.W.*, ASTC, FRACI

Robert George Robins, MSc PhD *N.S.W.*, MAMerlChE, ARACI, AMAusIMM

Geoffrey David Sergeant, BSc PhD *Wales*, CEng, FlntF, FAIE

Mark Sebastian Wainwright, MAppSc *Adel.*, PhD *McM.*, ARACI

Department of Biological Process Engineering

Head

Dr R. J. Hall

Department of Fuel Technology

Head

Associate Professor G. D. Sergeant

Department of Polymer Science

Head

Associate Professor J. K. Haken

Senior Administrative Officer

John Robin Gatenby, ASTC

Professional Officers

Robert Edmund Brand, BSc N.S.W., ASTC, ARACI
Eric Alan Vincent Durbin, MAppSc N.S.W., CEng, MChemE, MIEAust
Orest Dworjanyn, MSc N.S.W., ASTC, ARACI
David John Kelly, BSc BE Syd.
Cyril Leslie Samways, BSc Syd., MSc N.S.W.
Johannes Peter Smits, BSc(Tech) MSc N.S.W., CEng, MInstF, MAIE

School of Geography

Professor of Geography and Head of School
Jack Alan Mabbutt, MA Camb.

Professor of Geography
Barry Jardine Garner, BA Nott., MA PhD Northwestern

School of Food Technology

Professor of Food Technology and Head of School
Ronald Alexander Edwards, BSc PhD N.S.W., ASTC, FAIFST

Associate Professors

Terence Henderson Lee, BSc PhD N.S.W., FAIFST
Ronald Baden Howe Willis, BSc N.S.W., PhD Macq., ASTC, AAIFST

Senior Lecturers

Ronald Graham Bowrey, BE PhD N.S.W., AAIFST
Kenneth Alan Buckle, BSc PhD N.S.W., AAIFST, AFCIA
Michael Wootton, BSc PhD N.S.W., AAIFST, ARACI, MAGI

Lecturers

Graham Harold Fleet, MSc Qld., PhD Calif., AAIFST
Heather Greenfield, BSc PhD Lond., AAIFST

Tutors

John Robert Croker, BE N.S.W.
Louanne Mary Ryland, BSc N.S.W., AAIFST
Frances Maud Scriven, BSc N.S.W.
Richard Alexander Souness, BAppSc N.S.W.I.T.,
MAppSc GradDip N.S.W., AAIFST

Administrative Officer

Richard John Greenwood, BA N.S.W.

Professional Officers

Maxwell Robert Bell, BSc MAppSc N.S.W., ASTC
Annesley Jean Watson, BSc N.S.W., AAIFST

Honorary Visiting Fellow

Kevin Joseph Scott, BScAgr DipEd Syd.

Senior Lecturers

Frederick Charles Bell, BSc Syd., MSc PhD N.S.W., MSocSigmaXi
Ian Harry Burnley, MA Cant., PhD Well.
Andrew John Holsman, MA Camb., PhD N.S.W.
Michael Dick Melville, BScAgr PhD Syd.
Anthony Shepherd, MA Oxf.
Peter Leon Simons, BA PhD Syd.
Donald John Webb, BA DipEd Melb., MPhil Lond., PhD N.S.W.

Lecturers

Colin John Chartres, BSc Brist., PhD R'dg.
John Richard Dodson, MSc Monash, PhD A.N.U.
Anthony Kinnaird Milne, BA N.E., MA Syd., PhD Colorado
Colin Frederick Pain, MA Auck., PhD A.N.U.
Morgan Eugene Cyril Sant, BA Keele, MSc PhD Lond.
Hans Joachim Schneider, Geog Chil. State, DU Bordeaux
Susanne Rae Walker, MA Well., DPhil Oxf.
Frank Williamson, MSc Lond., PhD Syd.

Senior Tutor

Noel Galvin Lonergan, BA DipEd N.E.

Tutors

Christine Robyn Bradley, BA DipEd N.S.W.
Philip Weston Greenwood, BA Syd.
Glenda Laws, BA Syd.
Patricia Christina Vorst, BA Macq.
Alan Kenneth York, BSc N.S.W.

Administrative Assistant

Philip Brian Dunkley, BA N.S.W.

School of Metallurgy

Professor of Physical Metallurgy and Head of School

Hugh Muir, BMetE *Melb.*, ScD *M.I.T.*, CEng, FIM, FIEAust, MAusIMM

Research Professor of Physical Metallurgy

John Stephen Bowles, MSc *Melb.*, CEng, FIM

Professor of Chemical and Extraction Metallurgy

Vacant

Senior Administrative Officer

Reginald Arthur Ball, ASTC, MAusIMM, ARACI, AFAIM, FGAA(Res)

Senior Project Scientist

Anthony Samuel Malin, MSc PhD *N.S.W.*, CEng, MIM

Project Scientist

Ahmad Mukhtar Khalid, MSc *Panj.*, PhD *N.S.W.*, MASM, MNYAS

Professional Officers

Bernard James Baggaley, MSc *N.S.W.*, DipCer *N.Staffs Poly*
Edda Filson, ASTC, ARACI

Ulo Joasoo, MSc *N.S.W.*, ASTC, AMAusIMM

John Milton Newburn, MSc *N.S.W.*, ASTC, CEng, MIM

Frederick Henry Scott, BSc *N.S.W.*, MAIP

John Walton Sharp, BSc(Tech) *N.S.W.*

John Armitage Taylor, ASTC, FAISS, MIEAust, AMAusIMM

Honorary Associate

Bernhard John Frederick Ralph, BSc *Tas.*, PhD *Liv.*, FRACI, FTS

Department of Ceramic Engineering

Associate Professor

Eric Robert McCartney, BSc *Syd.*, PhD *N.S.W.*, FICeram, MIEAust, ARACI

Lecturer

Sviatoslav Antonovich Prokopovich, MSc *N.S.W.*, ASTC, MIEAust

Department of Chemical and Process Metallurgy

Senior Lecturers

Sidney Blairs, BSc PhD *Manc.*

Bruce Harris, BSc *Syd.*, MSc *N.S.W.*, AMAusIMM

Alan Philip Prosser, BSc PhD DIC *Lond.*, ARCS, ARACI, AMAusIMM

David Ronald Young, BSc(Eng), PhD *Lond.*, ARSM, AMAusIMM

Department of Materials

Associate Professor

Lewis Henry Keys, MSc PhD *N.S.W.*, ASTC, CEng, FIM

Senior Lecturer

Keith Robin Lee Thompson, BSc *Wales*, PhD *N.S.W.*, CEng, MIM

Lecturer

Peter Krauklis, BSc PhD *N.S.W.*, CEng, MIM

Department of Physical and Industrial Metallurgy

Associate Professors

Max Hatherly, MSc PhD *N.S.W.*, ASTC, CEng, FIM

Greig Richard Wallwork, PhD DSc *N.S.W.*, ASTC, CEng, FIM

Senior Lecturers

David John Haviland Corderoy, BSc *N.S.W.*, PhD *Sheff.*, CEng, FIM, MWeld(*Lond.*), MIEAust, MAusIMM

Peter George McDougall, BSc PhD *N.S.W.*, ASTC, CEng, MIM

Michael Bernard McGirr, BSc *Syd.*, PhD *N.S.W.*

Roy Thomas Southin, PhD *Camb.*, CEng, FIM, MIBF

School of Mining Engineering

Professor of Mining Engineering and Head of School

Frank Ferdinand Roxborough, BSc PhD *Durh.*, CEng, FIMinE, FIMM, MAusIMM

Administrative Assistant

Richard Rolls, BA *Macq.*

Professional Officers

Christopher Raymond Daly, BE MSc(Acoustics) *N.S.W.*

David Leslie Price, DipCE BE *Melb.*, MSc *N'cle.(U.K.)*, MIEAust

George Michael Savidis, BE *N.S.W.*

Joseph Arthur Shonhardt, BSc(Tech) MSc *N.S.W.*, AIM, AMAusIMM

Honorary Associate

Charles Harold Warman, MIEAust, MAusIMM, AWASM

Department of Mining Engineering

Senior Lecturers

Amal Krishna Bhattacharyya, BSc *Glas.*, MSc *Durh.*,
PhD *N'cle.(U.K.)*, CEng, PEng, MIMinE, MCIMM
Ross Leslie Blackwood, BE *Syd.*, PhD *Macq.*, MIEAust, MAIE,
AMAusIMM
Huw Ronald Phillips, BSc *Brist.*, MSc PhD *N'cle.(U.K.)*, CEng,
MIMinE, MIEE, MAIME
Edward George Thomas, BE PhD *Qld.*, MAusiMM, MAIME,
MCIMM

Lecturer

Gour Chand Sen, MSc *Wales*, PhD *Durh.*, FIEpE, MIMinE

Tutor

Victor Rudenno, BE PhD *N.S.W.*

Senior Lecturers

Ross Ernest Griffith, BSc *N.S.W.*, ATI
Thomas Stanislaus Hickie, BSc PhD *N.S.W.*, ASTC
Mstislav Stephen Nossar, DiplIng *Harbin*, PhD *N.S.W.*, FIEAust
Michael Thomas Pailthorpe, BSc PhD *N.S.W.*

Lecturer

Nigel Anthony Gull Johnson, BSc *N.S.W.*, PhD *Leeds*, ATI

Senior Project Scientist

John Raymond McCracken, BE MSc PhD *N.S.W.*

Professional Officers

Barry William Edenborough, BE PhD *N.S.W.*
Michael David Young, BSc PhD *N.S.W.*, ATI
Oto Zubzanda, DiplIng *T.U. Bratislava*, PhD *N.S.W.*

Honorary Associate

Arved Datyner, BSc PhD *Lond.*, FTI, FRIC, FSDC

Department of Mineral Processing

Senior Lecturer and Head of Department

Russell George Burdon, ME PhD *N.S.W.*, CEng, FinstE, FAIE,
MIMM, MAIME, ASASM, AMAusIMM

School of Wool and Pastoral Sciences

Associate Professor and Head of School

John Patrick Kennedy, MSc *N.S.W.*, BSc *Oxf.*, MAIAS

Professor of Pastoral Sciences

Haydn Lloyd Davies, PhD *W.Aust.*, BSc *Wales*, MAIAS

Associate Professors

John William James, BA *Qld.*, DSc *N.S.W.*
Walter Ragnall McManus, BScAgr *Syd.*, PhD *N.S.W.*
Euan Maurice Roberts, MAgrSc *N.Z.*, PhD *N.S.W.*

Administrative Officer

John Edward Lawrence

School of Textile Technology

Professor of Textile Technology and Head of School

Malcolm Chaikin, OBE, BSc PhD *Leeds*, DipEng *L.I.T.(Shanghai)*,
FTI, FTS

Professor of Textile Physics

Vacant

Associate Professors

Colin Herbert Nicholls, BSc *Adel.*, PhD *Leeds*, FRACI, FTI
Ronald Postle, BSc *N.S.W.*, PhD *Leeds*, FTI, FAIP

Senior Lecturers

Stephen James Filan, BAgEc *N.E.*, MSc *N.S.W.*
John Douglas McFarlane, BScAgr DipEd *Syd.*, MSc *N.S.W.*,
MAIAS
Douglas McPherson Murray, BAgSc PhD *Melb.*, MRurSc *N.E.*
Archibald Niven Sinclair, MVSc *Syd.*, FRCVS, FACBS, FACVS

Senior Instructor

Ronald Edward Sallaway

Professional Officer

Ian Rowden McRae, BSc (Forestry) *A.N.U.*

Broken Hill Division

Staff

Director

Professor J. E. Andersen

Librarian

Peter Geoffrey Longrigg, BA *P.N.G.*, DipLib *Canberra C.A.E.*,
ALAA

W.S. and L.B. Robinson University College

Head of Department of Science

Professor John Everard Andersen, BE *Melb.*, PhD *N.S.W.*,
FIEAust, MAusIMM, ARACI

Head of Department of Mining and Mineral Sciences

Professor Leon John Thomas, BSc PhD *Birm.*, CEng, FIEAust,
FIMinE, MAusIMM

Department of Mining and Mineral Sciences

Professional Officer

Kenneth James Murray, BSc *Syd.*, MSc *N.S.W.*, AMAusIMM

Mechanical Engineering

Lecturers

Llewellyn Ramsay Jones, BSc *N.Z.*, DipAm MEng *Sheff.*,
PhD *Wales*, MIEAust, MIMechE

Ian Lachlan MacLaine-cross, BE *Melb.*, PhD *Monash*, MIEAust,
MAIRAH, MSES

Chakravarti Varadachar Madhusudana, BE *Mys.*, ME *I.I.Sc.*,
PhD *Monash*, MIEAust

Mining Engineering

Senior Lecturer

Venkata Satyanarayana Vutukuri, BSc(Eng) *Ban.*, MS *Wis.*, MMGI,
AIME, AMAusIMM

The University of New South Wales Kensington Campus 1982

Theatres

Biomedical Theatres E27
 Central Lecture Block E19
 Classroom Block (Western Grounds) H3
 Electrical Engineering Theatre F17
 Keith Burrows Theatre J14
 Main Building Theatre K14
 Mathews Theatres D23
 Parade Theatre E3
 Science Theatre F13
 Sir John Clancy Auditorium C24

Buildings

Affiliated Residential Colleges
New (Anglican) L6
Shalom (Jewish) N9
Warrane (Roman Catholic) M7
 Applied Science F10
 Architecture H14
 Arts (Morven Brown) C20
 Banks F22
 Barker Street Gatehouse N11
 Basser College C18
 Biological Sciences D26
 Central Store B13
 Chancellery C22
 Chemistry
Dalton F12
Robert Heffron E12
 Civil Engineering H20
 Commerce (John Goodsell) F20
Dalton (Chemistry) F12
 Electrical Engineering G17
 Geography and Surveying K17
 Goldstein College D16
 Golf House A27
 Gymnasium B5
 House at Pooh Corner N8
 International House C6
 John Goodsell (Commerce) F20
 Kanga's House O14
 Kensington Colleges C17
Basser C18
Goldstein D16
Philip Baxter D14
 Main Building K15
 Maintenance Workshop B13

Mathews F23
 Mechanical and
 Industrial Engineering J17
 Medicine (Administration) B27
 Menzies Library E21
 Metallurgy E8
 Morven Brown (Arts) C20
 New College (Anglican) L6
 Newton J12
 Parking Station H25
 Philip Baxter College D14
 Robert Heffron (Chemistry) E12
 Sam Cracknell Pavilion H8
 Shalom College (Jewish) N9
 Sir Robert Webster
 (Textile Technology) G14
 Squash Courts B7
 Swimming Pool B4
 Unisearch House L5
 University Regiment J2
 University Union
 (Roundhouse)—Stage I E6
 University Union
 (Blockhouse)—Stage II G6
 University Union
 (Squarehouse)—Stage III E4
 Wallace Wurth School of Medicine C27
 Warrane College (Roman Catholic) M7
 Wool and Pastoral Sciences B8

General

Academic Staff Office C22
 Accountancy F20
 Admissions C22
 Adviser for Prospective Students C22
 Alumni and Ceremonials C22
 Anatomy C27
 Applied Geology F10
 Applied Science (Faculty Office) F10
 Architecture
 (including Faculty Office) H14
 Arts (Faculty Office) C20
 Australian Graduate
 School of Management G27
 Biochemistry D26
 Biological Sciences (Faculty Office) D26
 Biomedical Library F23
 Biotechnology D26
 Bookshop G17

Botany D26
 Building H14
 Careers and Employment C22
 Cashier's Office C22
 Centre for Biomedical Engineering A28
 Centre for Medical Education
 Research and Development C27
 Chaplains E15a
 Chemical Engineering and
 Industrial Chemistry F10
 Chemistry E12
 Child Care Centres N8, O14
 Civil Engineering H20
 Closed Circuit Television Centre F20
 Commerce (Faculty Office) F20
 Committee in Postgraduate Medical
 Education B27
 Community Medicine D26
 Computing Services Unit E21
 Drama D9
 Economics F20
 Education G2
 Electrical Engineering and
 Computer Science G17
 Engineering (Faculty Office) K17
 English C20
 Examinations C22
 Fees Office C22
 Food Technology F10
 French C20
 General Staff Office C22
 General Studies C20
 Geography K17
 German Studies C20
 Graduate School of the Built
 Environment H14
 Health Administration C22
 History C20
 History and Philosophy of Science C20
 Industrial Arts C1
 Industrial Engineering J17
 Institute of Languages G14
 Institute of Rural Technology B8b
 Kindergarten (House at Pooh Corner/
 Child Care Centre) N8
 Landscape Architecture H14
 Law (Faculty Office) E21
 Law Library E21
 Librarianship F23
 Library E21

Lost Property F20
 Marketing F20
 Mathematics F23
 Mechanical Engineering J17
 Medicine (Faculty Office) B27
 Metallurgy E8
 Microbiology D26
 Mining Engineering K15
 Music B11b
 National Institute of Dramatic Art C15
 Nuclear Engineering G17
 Off-campus Housing C22
 Optometry J12
 Organizational Behaviour F20
 Pathology C27
 Patrol and Cleaning Services F20
 Philosophy C20
 Physics K15
 Physical Education and
 Recreation Centre (PERC) B5
 Physiology and Pharmacology C27
 Political Science C20
 Postgraduate Extension Studies (Closed
 Circuit Television) F20
 Postgraduate Extension Studies (Radio
 Station and Administration) F23
 Psychology F23
 Public Affairs Unit C22
 Regional Teacher Training Centre C27
 Russian C20
 Science and Mathematics Course
 Office F23
 Social Work G2
 Sociology C20
 Spanish and Latin American Studies C20
 Sport and Recreation E15c
 Student Counselling and Research E15c
 Student Health E15b
 Student Records C22
 Students' Union E4
 Surveying K17
 Teachers' College Liaison Office F15b
 Tertiary Education Research Centre E15d
 Textile Technology G14
 Town Planning K15
 University Archives C22
 University Press A28
 University Union (Blockhouse) G6
 Wool and Pastoral Sciences B8a
 Zoology D26

Mineral Science**Senior Lecturer**

Barenya Kumar Banerji, MSc *Patna*, PhD *Leeds*, MAusIMM

Geology**Senior Lecturer**

Gerrit Neef, BSc *Lond.*, PhD *Well.*, FGS

Department of Science**Chemistry****Lecturer**

Derek Richard Smith, BSc PhD *Wales*

Senior Tutor

Robert Edward Byrne, MSc *N.S.W.*, ARACI, AMAusIMM

Mathematics**Senior Lecturers**

Zdenek Kviz, DipPhys *Brno*, CSc RerNatDr *Charles*, PhD *Prague*

Dennis William Trenerry, BSc PhD *Adel.*

Lecturer

David Charles Guiney, BSc PhD *Adel.*

Physics**Senior Lecturers**

Robert John Stening, MSc *Syd.*, PhD *Qld.*, DipTertEd *N.E.*, FRMetS, MAIP

Kenneth Reid Vost, BSc *Glas.*, MSc *N.S.W.*, AMAusIMM

Fowlers Gap Research Station

Officer-in-charge

Charles Richard Carter, BSc PhD *Syd.*

This Handbook has been specially designed as a source of reference for you and will prove useful for consultation throughout the year.

For fuller details about the University — its organization, staff membership, description of disciplines, scholarships, prizes, and so on, you should consult the Calendar.

The Calendar and Handbooks also contain a summary list of higher degrees as well as the conditions for their award applicable to each volume.

For detailed information about courses, subjects and requirements of a particular faculty you should consult the relevant Faculty Handbook.

Separate Handbooks are published for the Faculties of Applied Science, Architecture, Arts, Commerce, Engineering, Law, Medicine, Professional Studies, Science (including Biological Sciences and the Board of Studies in Science and Mathematics), the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education.

The Calendar and Handbooks are available from the Cashier's Office. The Calendar costs \$5.00 (plus postage and packing, 90 cents). The Handbooks vary in cost. Applied Science, Architecture, Arts, Commerce, Engineering, Professional Studies, and Sciences are \$3.00. Law, Medicine and AGSM are \$2.00. Postage is 90 cents in each case, or \$1.20 (\$3.00 interstate) for a complete set of books. The exception is General Studies, which is free (80 cents postage).