The University of New South Wales

Applied Science

1988 Faculty Handbook
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 12 September 1989, but may be amended without notice by the University Council.

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- 3010 Applied Geography (BSc) Full-time

Graduate Study: Course Outlines

- 8024 Land and Geographic Information System (MAppSc)
- 8025 Arid Lands Management (MAppSc)
- 5025 Arid Lands Management (GradDip)
- 8026 Remote Sensing (MAppSc)
- 5026 Remote Sensing (GradDip)
- 8045 Environment Studies (MEnvStudies)

Undergraduate Study: Subject Descriptions

Graduate Study: Subject Descriptions

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### School of Materials Science and Engineering

Undergraduate Study: Course Outlines

- 3025 Ceramic Engineering (BE) Full-time
- 3030 Ceramics (BScTech) Part-time
- 3125 Metallurgical Engineering (BMetE) Full-time
- 3030 Metallurgy (BScTech) Part-time

Graduate Study: Course Outlines

- 5035 Graduate Diploma in Materials

Undergraduate Study: Subject Descriptions

Graduate Study: Subject Descriptions

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### School of Mines

Undergraduate Study: Course Outlines

- 3000 Applied Geology (BSc) Full-time
- 3126 Mineral Engineering (BE) Full-time
- 3129 Chemical/Mineral Engineering (BE/BSc) Full-time
- 3140 Mining Engineering (BE) Full-time

Graduate Study: Course Outlines

- 8020 Engineering Geology-Hydrogeology-
  Environmental Geology (MAppSc)
- 8021 Mineral Exploration (MAppSc)
- 8092 Exploration Geophysics (MAppSc)
- 8093 Exploration Geochemistry (MAppSc)
- 8021 Hydrogeology and Groundwater Management (MAppSc)
- 8085 Waste Management (MAppSc)
- 5070 Waste Management (GradDip)
- 8055 Mineral Engineering (MAppSc)
- 8056 Mining Geomechanics (MAppSc) Part-time External
- 5040 Mining and Mineral Engineering (GradDip)

Undergraduate Study: Subject Descriptions

- Mining Engineering and
- Mineral Processing and Extractive Metallurgy
- Applied Geology

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### Calendar of Dates

#### 1989

**Session 1 (67 teaching days)**

- **27 February to 23 March**
- **Recess**
  - **24 March to 2 April**
  - **3 April to 8 June**
- **Study Recess**
  - **9 June to 14 June**
- **Midyear Recess**
  - **1 July to 23 July**
- **Examinations**
  - **15 June to 30 June**

**1990**

- **26 February to 12 April**
- **Recess**
  - **13 April to 22 April**
  - **23 April to 7 June**
- **Study Recess**
  - **8 June to 13 June**
- **Midyear Recess**
  - **30 June to 22 July**
- **Examinations**
  - **14 June to 29 June**

**Session 2 (67 teaching days)**

- **24 July to 22 September**
- **Recess**
  - **23 July to 21 September**
  - **22 September to 1 October**
  - **2 October to 31 October**
- **Study Recess**
  - **1 November to 6 November**
- **Examinations**
  - **7 November to 23 November**
- **Vacation Weeks**
  - **27 March to 2 April**
  - **16 April to 22 April**
  - **2 July to 8 July**
- **Common to Australian Universities**
  - **23 July to 21 September**
  - **22 September to 1 October**
  - **2 October to 31 October**
  - **1 November to 6 November**
  - **8 November to 24 November**
  - **14 June to 29 June**

### Important Dates for 1989

**January**

- **M 2**  New Year’s Day — Public Holiday
- **F 6**  Last day for acceptance of applications by the Admissions Section for transfer to another undergraduate course within the University.
- **W 18**  Last day for applications for review of results of assessment.
- **Th 26**  Australia Day — Public Holiday
- **T 31**  Enrolment period begins for new undergraduate students and undergraduate students repeating first year.

**February**

- **M 6**  Re-enrolment period begins for second and later year undergraduate and graduate students enrolled in formal courses. Students should consult the 1989 Re-enrolment Procedures booklet for details.
- **F 24**  Last day for students to discontinue 1989 enrolment and receive a refund of the Higher Education Administration Charge. Last day for acceptance of enrolment by new and re-enrolling students. Late fee payable thereafter if enrolment approved.
- **M 27**  Session 1 begins — all courses except Medicine III, IV and V.

**March**

- **F 10**  Last day applications are accepted from students who enrol in additional Session 1 or whole year subjects.
- **F 24**  Good Friday — Public Holiday
  - Mid-Session Recess begins
- **M 27**  Easter Monday — Public Holiday
April
Su  2  Mid-Session Recess ends
F  21  Last day for students to discontinue without failure subjects which extend over Session 1 only
T  25  Anzac Day — Public Holiday

May
T  2  Confirmation of Enrolment forms despatched to all students
T  9  Publication of Provisional Timetable for June examinations
Th 11  Last day for acceptance of corrected Confirmation of Enrolment forms
W 17  Last day for students to advise of examination clashes
T 30  Publication of timetable for June examinations

June
Th  8  Session 1 ends
F  9-14  Study Recess
M  12  Queen's Birthday — Public Holiday
Th 15  Examinations begin
F  30  Examinations end

July
M 10  Assessment results mailed to students
T 11  Assessment results displayed on University noticeboards
Su 23  Midyear Recess ends
M 24  Session 2 begins
M 31  Last day for applications for review of July assessment results

August
F  4  Last day applications are accepted from students to enrol in additional Session 2 subjects
Last day for students to discontinue without failure subjects which extend over the whole academic year

September
F  8  Last day for students to discontinue without failure subjects which extend over Session 2 only
T 19  Confirmation of Enrolment forms sent to all students
S 23  Mid-Session Recess begins
Th 28  Last day for acceptance of corrected Confirmation of Enrolment forms
F  29  Closing date for applications to the Universities and Colleges Admission Centre

October
M  2  Mid-Session Recess ends
Eight Hour Day — Public Holiday
T  3  Publication of provisional examination timetable for November examinations
W 11  Last day for students to advise of examination timetable clashes
T 24  Publication of timetable for November examinations

November
W  1  Session 2 ends
Th 2-7  Study Recess
W  8  Examinations begin
F  24  Examinations end

December
F  8  Assessment results mailed to students
M 11  Assessment results displayed on university noticeboards
Foreword

Engineering and science disciplines that are directly concerned with aspects of Australia’s resources have been established in the Faculty of Applied Science. Inter-disciplinary and multi-disciplinary course options are available to students through the various Schools within the Faculty — Biological Technologies, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, and Mines.

Undergraduate courses available are:
- Applied Geology (including specialization in Mineral and Energy Resources, Engineering Geology, and Geophysics)
- Ceramic Engineering
- Chemical Engineering (including Fuel Engineering)
- Food Science and Technology
- Geography (including Applied Physical Geography, Applied Economic Geography, and Human and Physical Resources)
- Industrial chemistry (including Polymer Science)
- Mining Engineering
- Metallurgical Engineering
- Mineral Engineering
- Mining Geology
- Petroleum Engineering
- Textile Technology (including Textile Chemistry, Textile Engineering, Textile Management, and Textile Physics)
- Wool and Pastoral Sciences
- Biotechnology, through an honours degree course in the Faculty of Science.

In most schools a variety of options are available, including joint degrees in other faculties (Science, and Law). Students should discuss their programmes with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

The importance of applied Science to the University of New South Wales, and to the wider community, is fully recognized and is especially referred to in the University Act of Incorporation. The Faculty of Applied Science is dynamic, with changing activities and programmes to meet the rapid technological developments in the applied sciences. Many of the staff of the Faculty have achieved international recognition for their work, and there is a continuing and wide range of research programmes underway. The staff are enthusiastic, and I hope that you will share their enthusiasm.

Once the term begins, it is essential that you participate fully in your study programme from the first day of the first year. You are also urged to play an active role in the extra-mural activities of the University, especially in the student societies in the Schools.

The format of this Handbook has been changed this year to make it more useful to you; we would welcome your comments. Also explanatory pamphlets and brochures are issued at enrolment and these, together with the Calendar, should be consulted for further information: you should not hesitate to contact the appropriate School offices if you have questions or problems.

G.J.S. Govett
Dean
Faculty of Applied Science
Staff

Comprises Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, and Mines.

Dean
Professor G.J.S. Govett

Chairman
Associate Professor J.P. Kennedy

Executive Officer
John David Collins, BSc PhD N.S.W, Ctext, ATI

Senior Administrative Officer
Graham John Baldwin, BA A.N.U.

Senior Project Officer
Desmond Rokfalussy, BE Bud.

Professional Officers
Badan-Singh Deol, MSc Punj'I, PhD Syd.
Oto Zubzanda, Dipling, T.U. Bratislava, PhD N.S.W.
Narendra Mohan Saha-Chaudhury, BME Jadavpur, MIEInd, MIEAust

Officer-in-charge, Drawing Office
Max Renner

Faculty Information

Some People Who Can Help You

If you require advice and information of a general nature contact:
Mr. G. Baldwin, Senior Administrative Officer, Room 1013, Applied Science Building. Tel. 697 4469

For information and advice of a specific nature, contact the appropriate school representative below:
Applied Geology Miss L. Bruce, Administrative Assistant. Room 915, Applied Science Building. Tel. 697 4262
Applied Bioscience Ms. L. Kulakauskas Room 110A Biological Sciences Building. Tel: 697 2050
Chemical Engineering and Industrial Chemistry Mr. P. Dunkley. Room 207, Applied Science Building. Tel. 697 4319.
Food Science and Technology Mr. R. Greenwood, Administrative Officer. Room 411, Applied Science Building. Tel. 697 4364.
Geography Ms. T. Bean, Administrative Assistant. Room G10, Geography and Surveying. Tel. 697 4386.
Materials Science and Engineering Mr. O. Andersen, Administrative Assistant. Room 110B, Materials Science and Engineering Building. Tel. 697 4436.
Mineral Engineering Associate Professor R. Robins. Room 213, Materials Science and Engineering Building. Tel. 697 4429.
Mining Engineering Professor F.F. Roxborough. Room 37, Main Building. Tel. 697 4525.
Textile Technology Mr D. Rose, Clerk. Room 102, Sir Robert Webster Building. Tel. 697 4477.
Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1988 should obtain a copy of the free booklet *Enrolment Procedure 1988* 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.

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 and the Physical Sciences Library.

The Biomedical Library

The Biomedical Library provides library services for staff and students from the Faculties of Medicine and Biological Sciences, and from the Schools of Biological Technologies Health Administration and Fibre Science and Technology. It is closely associated with the libraries of the teaching hospitals of the University.

The Biomedical Library is located on Levels 2, 3 and 4 of the Mathews Building Annex and is connected to the other Special Libraries via a link through the undergraduate collection.

Professional staff are available at the Reader Assistance Unit on Level 2 to provide reference services and to assist in the use of the catalogues. Instructional classes in the use of the library and in specific subject material can be arranged.

Computerized literature searches and interlibrary loans are also available.

Acting Biomedical Librarian       Betty McEwin

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate and undergraduate students in the pure and applied sciences, engineering and architecture. Details of the books, series and microfilms in the Physical Sciences Library are included in the microfiche monograph and serial catalogues and the items themselves are identified by the prefix 'P'. Serials with the prefix 'PJ' are not available for loan, but self-service photocopying facilities are located on Level 7. This library provides reference, reader assistance and reader education services and also, where appropriate, inter-library loan and literature-searching services. Trained staff are available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian       Marian Bate

The Bachelor of Social Science Degree Course (3420)

The Bachelor of Social Science (BSocSc) is a degree course 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 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 state of the course if their performance in at least two of the above disciplines is of a sufficiently high standard (Credit grade or better).

For further enquiries, contact the Arts Faculty Office, Room G1, Morven Brown Building. Tel. 697 2288.

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 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 award of 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 award of the degree.

3. The degree shall be awarded at Pass or Honours levels. 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.

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**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 award of 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 degree of BSc(Tech) and BSc(Eng) shall be awarded at Pass level 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.

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**General Education Program**

The University requires that undergraduate students undertake a structured program in General Education as an integral part of studies for their degree.

Among its objectives, the General Education program provides the opportunity for students to address some of the key questions they will face as persons, citizens and professionals.

The program requires students to undertake studies in three areas:
   (A) An introduction in non-specialist terms to an understanding of the environments in which humans function.
   (B) An introduction to, and a critical reflection upon, the cultural bases of knowledge, belief, language, identity and purpose.
   (C) An introduction to the development, design and responsible management of the systems over which human beings exercise some influence and control.

Subjects in categories (A) and (B) are in preparation. The exact form of category (C) is still being decided and should be clearly defined in 1989. This could involve, however, a slight subsequent change to the structure of the later years of degree programs.

There are differing requirements for students commencing before and from 1988:

**Students who commenced their undergraduate program before 1988.**

Students must complete a program of General Education in accordance with the requirements in effect when they commenced their degree program. Students yet to complete their General Education requirement may select subjects from any of the three categories of the new program.

**Students commencing their undergraduate program in 1988 and following.**

Students must complete a program of subjects selected from each of the three categories of study in accordance with the rules defined in the General Education Handbook and in sequences specified in the requirements for individual courses.

Further information may be obtained from the office of the Centre for Liberal and General Education, Room G58, Morven Brown Building, and the General Education Handbook.
Undergraduate Study:

Course Outlines

The Faculty of Applied Science consists of the Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines and the Centre for Petroleum Engineering. 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).

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, Mining Geology, 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, Mineral Engineering, Mining Engineering and Petroleum Engineering. A four-year course leading to the award of a Bachelor of Metallurgical Engineering is offered in Metallurgical Engineering.

Honours: In all courses the degree may be awarded with Honours. The award of Honours is determined by performance in subjects and in the final-year project. Honours are awarded in Class 1; Class 2 Division 1; and Class 2 Division 2.

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 Science and Technology; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; and in Metallurgy and Ceramics by the School of Materials Science and Engineering.

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 the 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) degree course, but 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.
Graduate Study:

Course Outlines

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1988* 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 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, Biochemical Engineering, Biotechnology, Corrosion Technology, Food Technology, Mining and Mineral Engineering, Remote Sensing, Textile Technology and Wool and Pastoral Sciences.

Candidates may register for all the research degrees subject to adequate research facilities and satisfactory supervision being available in the candidate's particular field of study. Where special conditions can be met the Faculty may grant permission to a candidate to enrol for the degree of Doctor of Philosophy on a part-time basis.

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.
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 previously been used 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 in the handbooks.

Appropriate subjects for each school appear at the end of each school section.

The identifying numerical prefixes for each subject authority are set out on the following page.

Servicing Subjects are those taught by a school or department outside its own faculty. Their subject descriptions are published in the handbook of the faculty which originates the subject and are also published in the handbook of the Faculty in which the subject is taught. These subjects will be found at the back of this handbook.

The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being the General Education subjects. For General Education subjects see the General Education Handbook which is available free of charge.

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.

<table>
<thead>
<tr>
<th>Information Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following is the key to the information which may be supplied about each subject:</td>
</tr>
<tr>
<td><strong>S1</strong> Session 1, <strong>S2</strong> Session 2</td>
</tr>
<tr>
<td><strong>F</strong> Session 1 <em>plus</em> Session 2, ie full year</td>
</tr>
<tr>
<td><strong>S1 or S2</strong> Session 1 <em>or</em> Session 2, ie choice of either session</td>
</tr>
<tr>
<td><strong>SS</strong> single session, but which session taught is not known at time of publication</td>
</tr>
<tr>
<td><strong>CCH</strong> class contact hours</td>
</tr>
<tr>
<td><strong>L</strong> Lecture, followed by hours per week</td>
</tr>
<tr>
<td><strong>T</strong> Laboratory/Tutorial, followed by hours per week</td>
</tr>
<tr>
<td><strong>hpw</strong> hours per week</td>
</tr>
<tr>
<td><strong>C</strong> Credit or Credit units</td>
</tr>
<tr>
<td><strong>CR</strong> Credit Level</td>
</tr>
<tr>
<td><strong>DN</strong> Distinction</td>
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School of
Applied Bioscience
School of Applied Bioscience

Head of School
Professor P. P. Gray
Administrative Assistant
Ms L. Kulakauskas

The former Schools of Biotechnology and of Food Science and Technology were amalgamated in January 1986 to form the School of Biological Technologies. The school was renamed the School of Applied Bioscience in 1988. The School consists of the Departments of Biotechnology and of Food Science and Technology.

Department of Biotechnology

Biotechnology employs a body of multidisciplinary expertise directed towards the utilization and recycling of natural resources by controlled biological action, usually in a reactor. Its study provides an appreciation of the capabilities of biological systems and the skills required to maximize these capabilities on the industrial scale. Particular attention is given to: the selection of the appropriate systems and their maximization by genetic and/or enzyme tailoring; the design of biological reactors and their ancillary equipment; optimization and control of the processes. It is by these means that products are manufactured at ensured standards of quality. The products include certain foods and beverages, baker’s yeast, antibiotics, steroids, vaccines, enzymes, amino acids, nucleotides, vitamins, organic acids, alcohols, metals, plant growth regulators and insecticides. Specific mammalian proteins, such as insulin and growth hormone, are also produced by microorganisms which have been genetically engineered to contain the appropriate mammalian gene.

Students proceeding to the BSc degree course through the Board of Studies in Science and Mathematics and who seek to undertake training in biotechnology may do so by combining such training with a major in another relevant discipline, preferably biochemistry, microbiology or chemistry. The fourth (Honours) year includes further formal training as well as research in biotechnology.

Alternatively, students with no previous training in biotechnology may undertake the biotechnology honours year, provided they have the necessary background training in biochemistry and microbiology; in such cases the Level III biotechnology units constitute the formal component.

Details of courses majoring in biotechnology are given in the Faculty of Science handbook.

Department of Food Science and Technology

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

A study of food science and technology demands an interdisciplinary and integrated approach, one that brings many scientific disciplines into focus. Its basis is in areas of chemistry, biochemistry and microbiology, and its borders merge with those of agriculture, engineering, nutrition and commerce.
The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods by optimum processes and equipment. 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 humans' food supply, who can contribute to the solution of one of the greatest problems of our age, how to make food supplies grow faster than population.

The Department 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.

**General Education Electives**

For details of changes in the General Education requirements refer to the table earlier in this chapter.

**Department of Food Science and Technology**

Professor, and Head of Department of Food Science and Technology
Ronald Alexander Edwards, BSc PhD N.S.W., ASTC, FAIFST, FTS

Associate Professors
Kenneth Alan Buckle, BSc PhD N.S.W., FAIFST, FCIA
Ronald Baden Howe Wills, BSc N.S.W., PhD Macq., ASTC, FAIFST
Michael Wootton, BSc PhD N.S.W., FAIFST, ARACI, MAGI

Senior Lecturers
Graham Harold Fleet, MSc Old., PhD Calif., AAIFST
Heather Greenfield, BSc PhD Lond., AAIFST

Lecturers
Prakash Lai Potluri, BSc Osmania, BSc Tech Nagpur, MS Georgia, PhD Texas A. & M., AAIFST
Jeanette Ramos, MS Philippines, GradDip N.S.W.
Frances Maud Scriven, BSc PhD N.S.W., AAIFST

Tutors
Tass Karalis, BSc N.S.W.
Catherine Elizabeth Meyer, BSc N.S.W.
Jane Elizabeth Paton, BSc N.S.W., AAIFST

Administrative Officer
Richard John Greenwood, BA N.S.W.

Professional Officers
Maxwell Robert Bell, BSc MAppSc N.S.W., ASTC
Raymond Allan Francke, BA Macq.
Annesley Jean Watson, BSc N.S.W., AAIFST

Honorary Associates
Gary William Pace, BSc N.S.W., PhD M.I.T.
Diana Joy Freeman, BSc MSc Syd.

*Conjoint appointment with The Garvan Institute of Medical Research.
**Course Outlines**

**Undergraduate Study**

**3060 Food Technology — Full-time Course**

**Bachelor of Science (Technology)**

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 (New Course) Hours per week

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001</td>
<td>Physics 1 or</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1.021</td>
<td>Introductory Physics 1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2.121</td>
<td>Chemistry 1A</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2.131</td>
<td>Chemistry 1B</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>10.001</td>
<td>Mathematics 1 or</td>
<td>6</td>
<td>6</td>
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<tr>
<td>10.011</td>
<td>Higher Mathematics 1 or</td>
<td>6</td>
<td>6</td>
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<tr>
<td>10.021B</td>
<td>General Mathematics 1B and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.021C</td>
<td>General Mathematics 1C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.031</td>
<td>Biology A</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>17.041</td>
<td>Biology B</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>24</td>
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### Year 2 (New Course)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.102A</td>
<td>Physical Chemistry</td>
<td>0 6</td>
</tr>
<tr>
<td>2.102B</td>
<td>Organic Chemistry</td>
<td>5 1</td>
</tr>
<tr>
<td>2.102D</td>
<td>Chemical and Spectroscopic Analysis</td>
<td>0 6</td>
</tr>
<tr>
<td>10.301</td>
<td>Statistics SA</td>
<td>2 2</td>
</tr>
<tr>
<td>41.101</td>
<td>Introductory Biochemistry</td>
<td>6 6</td>
</tr>
<tr>
<td>44.141</td>
<td>Microbiology</td>
<td>8 0</td>
</tr>
<tr>
<td>49.321</td>
<td>Introductory Nutrition</td>
<td>3 0</td>
</tr>
<tr>
<td>49.421</td>
<td>Introductory Food Engineering</td>
<td>0 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 24</td>
</tr>
</tbody>
</table>

### Year 3 (New Course)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.043B</td>
<td>Food Chemistry</td>
<td>6 0</td>
</tr>
<tr>
<td>49.131</td>
<td>Food Preservation</td>
<td>6 0</td>
</tr>
<tr>
<td>49.132</td>
<td>Plant Food Science</td>
<td>2 0</td>
</tr>
<tr>
<td>49.133</td>
<td>Animal Food Science</td>
<td>3 0</td>
</tr>
<tr>
<td>49.134</td>
<td>Quality Evaluation and Control</td>
<td>0 2</td>
</tr>
<tr>
<td>49.135</td>
<td>Food Technology Laboratory</td>
<td>0 6</td>
</tr>
<tr>
<td>49.231</td>
<td>Food Microbiology</td>
<td>4 0</td>
</tr>
<tr>
<td>49.331</td>
<td>Nutrition</td>
<td>0 3</td>
</tr>
<tr>
<td>49.431</td>
<td>Food Process Engineering</td>
<td>0 4</td>
</tr>
<tr>
<td>49.432</td>
<td>Computer Applications</td>
<td>0 2</td>
</tr>
<tr>
<td>42.102D</td>
<td>Principles of Biotechnology</td>
<td>3 0</td>
</tr>
<tr>
<td>2.0433</td>
<td>Analytical Instrumentation</td>
<td>0 3</td>
</tr>
<tr>
<td></td>
<td>General Education Subject</td>
<td>24 24</td>
</tr>
</tbody>
</table>

### Year 4 (Old Course)* Hours per week

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.140</td>
<td>Food Technology Project</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>38.141</td>
<td>Food Regulation and Control</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>38.146</td>
<td>Inspections</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>38.444</td>
<td>Computer Applications in Food</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Education Subject</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

**Plus three or more of the following electives to a total of not less than 9 hours per week.**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.003B</td>
<td>Organic Chemistry</td>
<td>0 6</td>
</tr>
<tr>
<td>18.121</td>
<td>Production Management</td>
<td>3 3</td>
</tr>
<tr>
<td>18.551</td>
<td>Operations Research</td>
<td>3 3</td>
</tr>
<tr>
<td>28.012</td>
<td>Marketing Systems</td>
<td>4 0</td>
</tr>
<tr>
<td>28.052</td>
<td>Marketing Research</td>
<td>0 4</td>
</tr>
<tr>
<td>38.142</td>
<td>Oenology</td>
<td>6 0</td>
</tr>
<tr>
<td>38.143</td>
<td>Cereal Technology</td>
<td>6 0</td>
</tr>
<tr>
<td>38.144</td>
<td>Treatment and Utilization of Food</td>
<td>0 3</td>
</tr>
<tr>
<td></td>
<td>Processing Wastes</td>
<td></td>
</tr>
<tr>
<td>38.145</td>
<td>Marine Products Technology</td>
<td>2 0</td>
</tr>
<tr>
<td>38.149</td>
<td>Postharvest Technology of Fruit and Vegetables</td>
<td>6 0</td>
</tr>
<tr>
<td>38.171</td>
<td>Special Topics in Meat Science</td>
<td>2 0</td>
</tr>
<tr>
<td>38.341</td>
<td>Food Microbiology 2</td>
<td>0 6</td>
</tr>
<tr>
<td>38.344</td>
<td>Yeast Technology</td>
<td>3 0</td>
</tr>
<tr>
<td>38.443</td>
<td>Food Engineering 3</td>
<td>6 0</td>
</tr>
<tr>
<td>38.541</td>
<td>Advanced Nutrition</td>
<td>0 3</td>
</tr>
<tr>
<td>38.544</td>
<td>Nutritional Evaluation of Foods</td>
<td>0 6</td>
</tr>
<tr>
<td>42.102A</td>
<td>Biotechnology A</td>
<td>6 0</td>
</tr>
<tr>
<td>42.102B</td>
<td>Biotechnology B</td>
<td>0 6</td>
</tr>
</tbody>
</table>

or such other electives, to a total of not less than 9 hours per week, as approved by the Head of School.

During Years 2, 3 and 4 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.

*The course is being revised. Contact the Department for further details.

**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 Year 4 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.

### Stage 5

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.043B</td>
<td>Food Chemistry</td>
<td>6 0</td>
</tr>
<tr>
<td>49.231</td>
<td>Food Microbiology</td>
<td>4 0</td>
</tr>
<tr>
<td>42.102D</td>
<td>Principles of Biotechnology</td>
<td>3 0</td>
</tr>
<tr>
<td>49.331</td>
<td>Nutrition</td>
<td>0 3</td>
</tr>
<tr>
<td>49.431</td>
<td>Food Process Engineering</td>
<td>0 4</td>
</tr>
<tr>
<td>49.432</td>
<td>Computer Applications</td>
<td>0 2</td>
</tr>
<tr>
<td></td>
<td>General Education Subject</td>
<td>0 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 13</td>
</tr>
</tbody>
</table>

### Stage 6

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.131</td>
<td>Food Preservation</td>
<td>6 0</td>
</tr>
<tr>
<td>49.132</td>
<td>Plant Food Science</td>
<td>2 0</td>
</tr>
<tr>
<td>49.133</td>
<td>Animal Food Science</td>
<td>3 0</td>
</tr>
<tr>
<td>49.134</td>
<td>Quality Evaluation and Control</td>
<td>0 2</td>
</tr>
<tr>
<td>49.135</td>
<td>Food Technology Laboratory</td>
<td>0 6</td>
</tr>
<tr>
<td>2.0433</td>
<td>Analytical Instrumentation</td>
<td>0 3</td>
</tr>
<tr>
<td></td>
<td>General Education Subject</td>
<td>2 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 13</td>
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</table>

### Stages 1 and 2

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001</td>
<td>Physics 1 or Introductory Physics 1</td>
<td>S1 6 S2 6</td>
</tr>
<tr>
<td>1.021</td>
<td>Chemistry 1A</td>
<td>6 0</td>
</tr>
<tr>
<td>2.121</td>
<td>Chemistry 1B</td>
<td>0 6</td>
</tr>
<tr>
<td>10.001</td>
<td>Mathematics 1 or Higher Mathematics 1† or</td>
<td>6 6</td>
</tr>
<tr>
<td>10.021B</td>
<td>General Mathematics 1B and General Mathematics 1C</td>
<td></td>
</tr>
<tr>
<td>17.031</td>
<td>Biology A</td>
<td>6 0</td>
</tr>
<tr>
<td>17.041</td>
<td>Biology B</td>
<td>0 6</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.102B</td>
<td>Organic Chemistry</td>
<td>5 1</td>
</tr>
<tr>
<td>2.102D</td>
<td>Chemical and Spectroscopic Analysis</td>
<td>0 6</td>
</tr>
<tr>
<td>41.101</td>
<td>Introductory Biochemistry</td>
<td>6 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 13</td>
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</tbody>
</table>

### Stage 4

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.102A</td>
<td>Physical Chemistry</td>
<td>0 6</td>
</tr>
<tr>
<td>10.301</td>
<td>Statistics SA</td>
<td>2 2</td>
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<tr>
<td>44.141</td>
<td>Microbiology</td>
<td>8 0</td>
</tr>
<tr>
<td>49.321</td>
<td>Introductory Nutrition</td>
<td>3 0</td>
</tr>
<tr>
<td>49.421</td>
<td>Introductory Food Engineering</td>
<td>0 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 11</td>
</tr>
</tbody>
</table>
Graduate Study

The School of Applied Bioscience conducts formal courses leading to the award of Master of Applied Science degrees in Biotechnology, Food Technology and Food Engineering and Graduate Diplomas in Biotechnology, Biochemical Engineering and 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 biotechnology or 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.

Department of Biotechnology

5320
Biochemical Engineering Graduate Diploma Course*

Graduate Diploma GradDip

The Department offers a course in biochemical engineering which leads to the award of a graduate diploma (GradDip). The course is open to graduates in the biological sciences, chemistry, chemical engineering or agriculture, and can be completed in one year of full-time or over a longer period by part-time study. It contains a component of graduate level ‘bridging’ subjects, designed to facilitate the introduction of graduates with a variety of backgrounds to the current practice of biochemical engineering.

The normal entrance requirement is an appropriate degree or equivalent qualification in biological sciences, chemistry, chemical engineering or agriculture. Intending students are referred to the conditions for the award of Graduate Diplomas set out later in this handbook.

*This course is being revised. Contact the Department for further details.

5015
Biotechnology Graduate Diploma Course*

Graduate Diploma GradDip

The graduate diploma course provides the opportunity for graduates with no previous tuition in biotechnology to undertake training in this discipline.

A degree in a science-based course is required for admission. If the degree course has not included a biology component, the candidate is required to undertake some basic biology training as a prerequisite or co-requisite.

Under normal circumstances, students whose previous training has included a substantial component of biotechnology will not be admitted to the course.

The course comprises study of undergraduate and graduate formal subjects, plus extensive laboratory training in biotechnology.

The diploma is awarded after one year’s full-time study, consisting of an average of 20 hours per week, or two years part-time study, consisting of an average of 10 hours per week. The program includes the listed obligatory subjects plus sufficient of the listed elective subjects to meet the hours of study required. The electives include subjects necessary for students without previous tuition in biochemistry and/or microbiology, as well as alternatives for those with previous tuition in these disciplines. The choice of electives in each individual case is subject to approval by the Head of School.

*This course is being revised. Contact the Department for further details.

<table>
<thead>
<tr>
<th>Session 2</th>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
</tr>
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<tbody>
<tr>
<td>42.213G</td>
<td>Biochemical Methods</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>42.214G</td>
<td>Biotechnology</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>42.283G</td>
<td>Process Dynamics and Biomedical Engineering Design</td>
<td>0</td>
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Obligatory Subjects

<table>
<thead>
<tr>
<th>42.102A Biotechnology A</th>
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<tr>
<td>42.102B Biotechnology B</td>
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<tr>
<td>42.215G Practical Biotechnology</td>
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</table>

Elective Subjects

<table>
<thead>
<tr>
<th>42.102C Microbial Genetics</th>
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</thead>
<tbody>
<tr>
<td>42.104G Graduate Seminars</td>
<td>2</td>
</tr>
<tr>
<td>42.407G Biological Principles</td>
<td>3</td>
</tr>
<tr>
<td>42.408G Bioengineering Principles</td>
<td>3</td>
</tr>
<tr>
<td>44.101 Introductory Microbiology</td>
<td>6</td>
</tr>
<tr>
<td>44.121 Microbiology 1</td>
<td>0</td>
</tr>
</tbody>
</table>

Other suitable electives from the Department of Food Science and Technology and/or other Schools.
Master of Applied Science (Biotechnology) MApSc(Biotech)

The Department offers a formal graduate course at the masters' level. The course includes advanced treatments of all areas of biotechnology. It is open to graduates with a four-year degree in biotechnology or a related discipline, or who have, in the opinion of the Higher Degree Committee, acquired equivalent qualifications or experience. Intending students are referred to Conditions for the Award of Graduate Degrees set out later in this handbook.

The course consists of lectures, tutorials, practical sessions, case history studies and a supervised project. The minimum period of registration before the award of the degree is two sessions for full-time students and four sessions for part-time students.

An acceptable course would be a program of subjects involving a minimum of 18 hours per week for two sessions full-time or a minimum of 9 hours per week for four sessions part-time. Course details are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.401G Applied Genetics</td>
<td>S1 0  S2 5</td>
</tr>
<tr>
<td>42.402G Peptide and Protein Technology</td>
<td>0 5</td>
</tr>
<tr>
<td>42.403G Biochemical Engineering</td>
<td>0 5</td>
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<tr>
<td>42.404G Microbial Mineral Processing</td>
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<tr>
<td>42.405G Biodeterioration</td>
<td>2 0</td>
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<tr>
<td>42.406G Applied Cellular Physiology</td>
<td>5 0</td>
</tr>
<tr>
<td>42.407G Biological Principles</td>
<td>3 0</td>
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<tr>
<td>42.408G Bioengineering Principles</td>
<td>3 0</td>
</tr>
<tr>
<td>42.306G Biotechnology Project (Major)</td>
<td>7 7</td>
</tr>
<tr>
<td>42.502G Biotechnology Project (Minor)</td>
<td>3 3</td>
</tr>
</tbody>
</table>

Elective components:

Elective subjects, including some undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval.

Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science and would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% nor more than 50% of the program.
2. A minor strand of broader based material comprising up to 25% of the total program.
3. Undergraduate material (generally designated as subjects without a suffixed G or X number) may be included in one or both strands but may not exceed 25% of the non-project component.
4. At least 60% of the non-project component must be taken in the Department of Biotechnology unless otherwise approved by the Head of School. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

Department of Food Science and Technology

The Department conducts formal courses leading to the award of the Master of Applied Science degrees and of the Graduate Diploma in food technology.

Master of Applied Science Degree Courses

The MApSc degree courses provide for a comprehensive study of theoretical and applied aspects of the science, technology and engineering of foods. The courses are elective in nature providing an opportunity for graduates to apply their basic skills in areas relevant to these fields of applied science in which the School has developed special expertise.

Graduate courses are available for Master of Applied Science degree programs in the following areas:

Food Technology Course 8030
Food Engineering Course 8035

Intending candidates are invited to contact the Head of the School for advice and recommendation. The basis of an acceptable program would be formal study aggregating at least 18 hours weekly for 2 sessions full-time or 9 hours weekly for 4 sessions or 6 hours weekly for 6 sessions part-time, and which would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% no more than 50% of the program.
2. A minor strand of broader based material comprising up to 25% of the total program.
3. Undergraduate material (generally designated as subjects without a suffixed G or X number) may be included in one or both strands but may not exceed 25% of the non-project component.
4. At least 60% of the non-project component must be taken in the School of Applied Bioscience unless otherwise approved by the Head of School. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

8030
Food Technology Graduate Course*

Master of Applied Science MApSc

The MApSc course in Food Technology is particularly relevant to graduates in Agriculture, Applied Science and Science with principal interests in chemistry, biochemistry, microbiology, physiology, nutrition and engineering. This is a formal course consisting of core component (including a project), and an elective component that allows reasonable flexibility and a choice of subjects in food science and technology based on the candidate's background, subject to the availability of staff and resources.

The course comprises:
**Core components**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week*</th>
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</thead>
<tbody>
<tr>
<td>49.152G</td>
<td>Principles of Food Preservation</td>
<td>3</td>
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<tr>
<td>49.155G</td>
<td>Food Technology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>49.170G</td>
<td>Seminar</td>
<td>1</td>
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<tr>
<td>49.171G</td>
<td>Major Research Project</td>
<td>9</td>
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<tr>
<td>OR</td>
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<tr>
<td>49.172G</td>
<td>Research Project</td>
<td>6</td>
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<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49.173G</td>
<td>Minor Project</td>
<td>3</td>
</tr>
</tbody>
</table>

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

**Elective components**

The elective subjects making up the remainder of the hours, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of School.

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**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.

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 Food Technology (GradDip) is awarded on the successful completion of one year of full-time study (17 hours/week), or two years of part-time study (8½ hours/week). It involves the following program:

<table>
<thead>
<tr>
<th>Core components</th>
<th>Hours per week*</th>
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</thead>
<tbody>
<tr>
<td>49.152G Principles of Food Preservation</td>
<td>3</td>
</tr>
<tr>
<td>49.153G Plant Food Products</td>
<td>1</td>
</tr>
<tr>
<td>49.154G Animal Food Products</td>
<td>1½</td>
</tr>
<tr>
<td>49.155G Food Technology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>49.251G Food Microbiology</td>
<td>2</td>
</tr>
</tbody>
</table>

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

**Elective components**

The elective subjects making up the remainder of the hours, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval 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.
Subject Descriptions

Undergraduate Study

Department of Food Science and Technology

38.140 Food Technology Project
(Year 4, Old Course)  F T8
Pre- or co-requisites: 38.131, 38.132, 38.133, 38.134.  
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
(Year 4, Old Course)  S1 L3
Food legislation: State and NHMRC food standards and mechanisms; Codex standards; case studies in food standards development; food and nutrition policy. 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, hazard analysis and critical control point (HACCP) concepts, case studies.

38.142 Oenology (Year 4, Old Course)  S1 L2T4
Pre-requisite: 38.132.  
History and nature of grape wines; grape and wine statistics; concept of cultivars within Vitis vinifera; other Vitis species; wine 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, 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
(Year 4, Old Course)  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
(Year 4, Old Course)  S2 L2T1
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
(Year 4, Old Course)  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 (Year 4, Old Course)  S2 T3
Inspection of food processing plants, growing areas and research stations in Sydney metropolitan area, New South Wales, Victoria and South Australia.

38.149 Postharvest Technology of Fruit and Vegetables
(Year 4, Old Course)  S1 L1T5
Prerequisite: 38.132.  
The systems available for the storage and handling of fruit and vegetables after harvest and the causes of wastage and deterioration in these systems. The effects of temperature, humidity, atmosphere control of the physiology and biochemistry of the product. The application of basic knowledge to develop improved commercial storage and marketing systems.
38.171 Special Topics in Meat Science  
(Year 4, Old Course)  
Prerequisite: 38.133 or equivalent.

Students will be allocated a specific area of study on an aspect of meat science involving a literature survey, industrial visits and the presentation of a seminar and a written report on the specific area of study.

38.341 Food Microbiology 2  
(Year 4, Old Course)  
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, sub-lethal 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  
(Year 4, Old Course)  
Prerequisite: 38.331.


38.443 Food Engineering 3  
(Year 4, Old Course)  
Prerequisites: 38.421, 38.432.

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 filtration, mixing, concentration, refrigeration and handling of foods; laboratory work involving automatic flow control, evaporation, computer control.

38.444 Computer Applications in Food Technology  
(Year 4, Old Course)  
Introduction to VAX/VMS, KRONOS and other control languages; the use of SPSS, MPOS and other program packages to solve problems in food technology.

38.541 Advanced Nutrition  
(Year 4, Old Course)  
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.

38.544 Nutritional Evaluation of Foods  
(Year 4, Old Course)  
Prerequisites: 2.043L, 38.134.

Analytical methods for nutrients in foods, including advanced analytical techniques. Evaluation of nutrients in specific food groups, and the effect of processing and preparation on nutrient value of foods.

49.131 Food Preservation  
Prerequisites: 2.102A, 2.102B, 2.102D, 38.421, 38.521, 41.101, 44.101

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, ionizing radiations, modified atmospheres in food preservation. Chemical and microbial stability of foods. Packaging requirements for preserved foods. Water relations of foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

49.132 Plant Food Science  
Prerequisites: 2.102A, 2.102B, 2.102D, 38.421, 38.521, 41.101, 44.101


49.133 Animal Food Science  
Prerequisites: 2.102A, 2.102B, 2.102D, 38.521, 41.101, 44.101

Nature and distribution of world animal food resources. Meat: Muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. Milk and dairy products: Chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter, frozen, chilled and dried milk-derived foods. Marine products. Nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinating and fermentation; fish meal and fish protein concentrate. Egg products. Structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation.
tion of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

49.134 Quality Evaluation and Control  
Prerequisites: 10.301, 38.131, 38.132, 38.133, 38.331  
An introduction to food quality, its nature, assessment and control during handling, processing and storage; the use of objective and sensory methods of assessment; an introduction to HACCP, TTT and PPP concepts.

49.135 Food Technology Laboratory  
Prerequisites: 38.131, 38.132, 38.133, 38.331  
A program of exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems. Ability to carry out test methods and to interpret results will be a major component in student assessment.

49.140 Project  
Prerequisites: Completion of Year 3 subjects  
The student undertakes an individual project involving a literature survey, an experimental investigation, the preparation of a detailed report on a selected topic in food science and technology, and presentation of seminars on a literature review and experimental results.

49.141 Field excursions  
Prerequisites: Completion of Year 3 subjects  
Inspection of food processing plants, growing areas and research stations in the Sydney metropolitan area, New South Wales and interstate.

49.142 Food Legislation  
Prerequisites: Completion of Year 3 subjects  
An overview of Federal and State regulations affecting the production and marketing of foods; food imports and exports; mechanisms for development of food standards. Principles of approval and usage of food additives. Codex standards. Implementation of food regulations.

49.143 Food Industry Management  
Prerequisites: Completion of Year 3 subjects  
An introduction to food industry management, accounting, finance, marketing, industrial relations and communication skills.

49.144 Food Product Development  
Prerequisite: Completion of Year 3 subjects  
The steps involved in new product development; role of market research and advertising. Costing procedures, new product failure, case studies. Practical exercises in new food product development.

49.145 Food Processing Wastes  
Prerequisite: 38.134  
Effects of waste discharges into waterways. Treatment of water for domestic and industrial applications; water re-use; process modifications for effluent reduction. Origin, composition, treatment, disposal and utilisation of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants.

49.146 Cereal Technology  
Prerequisite: 38.134  
A treatment in greater depth of the following topics dealt with in 49.132: 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; 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.

49.231 Food Microbiology  
Prerequisites: 44.101 and 44.121  
A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi and viruses associated with foods and beverages. Food spoilage: specific food-microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control: spoilage of specific commodities. Food-borne microbial disease: foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. Food fermentation: microbial ecology and biochemistry of fermentations; fermentations of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. Microbiological examination of foods: sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, food-borne pathogenic species, principal spoilage species. Microbiological quality control: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept.

49.241 Advanced Food Microbiology  
Prerequisite: 49.231  
An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage and food fermentations. Emphasis on: new developments in food microbiology; economic consequences of microorganisms in foods; exploitation of microorganisms in novel processes for the production of food ingredients and processing aids; new technologies for the detection of microorganisms in foods, including enzyme immunoassay, DNA-probes, bioluminescence, impedance, epifluorescent-filtration methods; practical problems associated with the microbiological analysis of foods and interpretation of data.
49.321 Introductory Nutrition S1 L2 T1
Co-requisite: 41.101
Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

49.331 Nutrition S2 L2 T1
Prerequisite: 38.521
Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group basis.

49.341 Advanced Nutrition S2 L3 T3
Prerequisite: 49.331
Nutrition topics in relation to food and nutrition policy; the food industry and community nutrition in developing and industrialised countries; food enrichment, food allergies, supplementary feeding programs and nutrition education. Principles of the nutrient evaluation of foods. Practical sessions and computing using nutrient data bases.

49.421 Introductory Food Engineering S2 L2 T1
Prerequisites: 1.001 or 1.021 and 10.011 or 10.021B and 10.021C
Units and dimensions, dimensionless groups, dimensional analysis; material and energy balances; steady state and unsteady state heat transfer; selection of insulation, heat exchangers and heat transfer equipment; refrigeration, freezing, filtration.

49.431 Food Process Engineering S2 L2 T2
Prerequisite: 38.421
Food rheology, fluid flow, thermal properties of foods, evaporation, psychrometry, dehydration, extraction, size reduction, extrusion, measurement and control of process variables. Laboratory exercises in food rheology, fluid flow, heat transfer, evaporation, psychrometry, drying, instrumentation and process control.

49.432 Computer Applications SS L1 T1
Prerequisite: 10.301
Introduction to VAX/VMS, VM/CMS, MS-DOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology.

49.441 Advanced Food Engineering S1 L2 T1
Prerequisites: 38.432, 38.444
Physical properties and measurement of food texture; numerical techniques, integrated food processing operations and process control; economics of process development; recent developments in food engineering.

49.442 Food Packaging S1 L2 T1
Co-requisite: 49.131
Chemical and physical properties of packaging materials; interaction between package and food, selection of packaging materials and systems, evaluation of packaging materials and systems, package design criteria; laboratory work on physical properties of packaging materials and evaluation of packaging materials and systems.

Department of Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

42.102A Biotechnology A S1 L3T3
Prerequisites: 41.101 and 44.101 (Pass Conceded (PC) or Terminating Pass (PT) awarded prior to Session 2, 1983, is not acceptable).

The basic principles involved in the operation of microbial processes on an industrial scale. Includes: 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; 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: 42.102A (Pass Conceded (PC) or Terminating Pass (PT) awarded prior to Session 2, 1983, is not acceptable).

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 are 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.
**42.102C Microbial Genetics**

*Prerequisites: 41.101 or 44.101. Excluded: 43.102.*

A detailed study of the mutational basis of microbial variation. Mutagens; mechanisms of mutagenesis; induction, enrichment, isolation and characterization of mutants; mechanisms of repair of mutational damage. Systems of gene transfer and recombination in fungi, bacteria and bacterial viruses; the use of these systems in constructing genetic maps, and as tools for probing aspects of microbial physiology and biochemistry. Genetic control of gene expression; the operon concept and its application to specific regulatory systems. Genetic code, collinearity between a gene and its product, genes within genes, suppression of mutations. Restriction and modification of DNA; genetic engineering — its implications and prospects. Genetics of nitrogen fixation.

**42.102D Principles of Biotechnology**

*Prerequisite: 44.101*

Lecture component of 42.102A Biotechnology A.

**42.102E Biotechnology Laboratory**

*Prerequisite: 42.102D*

Laboratory component of 42.102A Biotechnology A.

**42.103 Biotechnology (Honours)**

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects.

**42.105 Biological Process Engineering**

*Prerequisite: 44.101.*


**42.114 Fermentation Processes**

Factors governing the use of microorganisms in industrial processes, including the selection, maintenance and improvement of microorganisms, the control of environmental factors, batch and continuous flow operational patterns, product recovery, process optimization and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.
Department of Food Science and Technology

Food Science and Technology is a Department within the School of Applied Bioscience.

38.151G Introductory Food Science  S1 L1 S2 T1

An introduction to the history of food preservation and human nutrition. Current world food patterns, organizations and trade. Food development programs, regional and international agencies and activities. Parameters of food quality: food choice and social behaviour, food and society. Students present a seminar on aspects of food science in Session 2.

38.152G Food Process Laboratory  S2 T6

Co- or prerequisites: 38.164G, 38.165G, 38.166G, 38.350G or their equivalent.

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

38.153G Food Technology Seminar  F 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.

38.157G Technology of Cereal Products  S1 L2

Prerequisite: 38.132 or 38.165G or equivalent.


38.158G Marine Products  S1 L2

Prerequisite: 38.133 or 38.166G or equivalent.


38.161G Food Additives and Toxicology  S2 L2

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  S1 L1 T5

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 disinfestation and quarantine measures. Examination of current commercial storage and marketing operations.

38.351G The Microbial Ecology of Foods  S2 L2 T4

Prerequisite: an introductory subject in microbiology, 38.350G, 38.331 or equivalent.

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; sub-lethal injury; indicator organisms. Rapid methods for microbial enumeration and identification. Control of microorganisms in foods; microbiological quality control, food legislation, microbiological criteria.

38.451G Advanced Food Engineering  S1 L2 T1

Prerequisites: 38.421 and 38.432 or an introductory subject in material and energy balances, heat transfer and fluid mechanics or equivalent.

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 L2 T1

Prerequisite: 38.451G or equivalent.

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

Prerequisite: 38.553G or equivalent.

Detailed treatment of the role of 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

Co- or prerequisite: 2.271G or equivalent.

Nutrient assay of foods including bench and instrumental techniques. Human nutritional assessment by anthropometric, dietary and biochemical methods.

49.150G Introductory Food Science

An introduction to the history of food preservation and human nutrition. Current world food patterns, organizations and trade. Food development programs, regional and international agencies and activities. Parameters of food quality; food choice and social behaviour, food and society. Students present a seminar on aspects of food science in Session 2.

49.151G Food Chemistry and Enzymology

Chemistry and function of carbohydrates, proteins, lipids, vitamins, minerals and pigments; non-enzyme browning reactions and autoxidation; effects of food processing on the functional properties of food components. Characteristics of enzymes: factors affecting enzyme action; the hydrolases and oxidoreductases; respiration, glycolysis, autolysis, enzymic browning and fat decomposition.

Basic laboratory techniques for the analysis of food components.

49.152G Principles of Food Preservation

Spoilage control by traditional and modern techniques. Technology of food preservation by heat, chilling and freezing, sun drying and dehydration, salt, sugar, acid, chemical preservatives, ionizing radiations, modified atmospheres. Chemical and microbial stability of foods. Packaging requirements for preserved foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

49.153G Plant Food Products

Cereals: Structure, composition, properties and uses of cereal grains with emphasis on wheat; processing and technology of wheat and rice. Sugars: Sources, types, properties of sugars in foods; sugar milling and refining. Fruit and vegetables: Nutrient composition; principles of postharvest physiology, storage and handling. Lipids: Sources and composition of fats and oils, methods of extraction and processing. Non-microbial hazards in foods: Minerals, proteins, acids, goitrogens, cyanogens, carcinogens; spices and flavours. Plant protein: Sources, composition, extraction and uses in foods with emphasis on soybean. Tea, cocoa and coffee: Production, composition and processing.

49.154G Animal Food Products

Nature and distribution of world animal food resources. Meat: Muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. Milk and dairy products: Chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter, frozen, chilled and dried milk-derived foods. Marine products: Nature and distribution of world fishery resources; teleostian and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinating and fermentation; fish meal and fish protein concentrate. Egg products: Structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

49.155G Food Technology Laboratory

Prerequisites: 49.152G, 49.153G, 49.154G or their equivalent.

A program of laboratory and pilot plant exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems.

49.160G Dairy Technology

Prerequisite: 49.154G or equivalent.

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.

49.161G Oenology


49.162G Technology of Cereal Products

Prerequisite: 49.153G or equivalent.

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...

49.163G Marine Products  
Prerequisite: 49.154G or equivalent.

49.164G Food Additives and Toxicology  
Functions, modes of action of food additives, consequences of use, ethical and legislative considerations. National, State and international attitudes and standards. Principles of toxicological testing, the evaluation of results.

49.165G Postharvest Physiology and Handling of Fruit and Vegetables  
Pre- or Co-requisite: 49.153G or equivalent.
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.

49.166G Postharvest Storage of Foods  
Prerequisite: 49.155G or equivalent
Preharvest considerations, postharvest physiology and biochemistry, postharvest factors affecting quality, methods of storage and handling, marketing strategies for selected food commodities.

49.170G Seminar  
Students present material arising from literature and/or laboratory assignments and/or plant investigations in the food and related industries. Critical assessments are made of the results of research in food science and technology.

49.171G Major Research Project  
A detailed investigation of a selected topic in food science and technology including submission of a project report.

49.172G Research Project  
An investigation of an aspect of food science and technology and submission of a project report.

49.173G Minor Project  
A study of an aspect of food science and technology and submission of a project report.

49.174G Special Topics in Food Science and Technology  
An individually supervised program of investigation in specialised aspects of food science and technology not otherwise offered. Embraces a literature review, laboratory work and/or industrial liaison as may be appropriate. Available only to appropriately qualified students.

49.175G Special Topics in Food Science and Technology  
A similar but shorter investigation to that outlined in 49.174G.

49.176G Reading Assignment  
A reading assignment in an area supporting candidates' major disciplines or commodity interests. Presentation of a seminar may be required.

49.250G Introductory Food Microbiology  
An integrated lecture and laboratory program providing an introduction to food microbiology; microorganisms associated with food; factors affecting microbial growth and survival; enumeration of microorganisms in foods; microbial food spoilage; foodborne microbial disease and food hygiene; food fermentations.

49.251G Food Microbiology  
Prerequisite: 49.250G or other introductory microbiology subject
A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi and viruses associated with foods and beverages. Food spoilage: specific food-microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control of spoilage of specific commodities. Food-borne microbial disease; foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. Food fermentation: microbial ecology and biochemistry of fermentations; fermentations of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. Microbiological examination of foods: sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne pathogenic species, principle spoilage species. Microbiological quality control: specifications and standards, decision criteria; hazard analysis and critical control point (HACCP) concept.
49.252G Advanced Food Microbiology  S2 L2 T4
Prerequisite: 49.251G or equivalent.
An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne disease and food fermention. Emphasis on: new developments in food microbiology; economic consequences of microorganisms in foods; exploitation of microorganisms in novel processes for the production of food ingredients and processing aids; new technologies for the detection of microorganisms in foods, including enzyme immunoassay, DNA-probes, bioluminescence, impedance, epifluorescent-filtration methods; practical problems associated with the microbiological analysis of foods and interpretation of data.

49.350G Introductory Nutrition  S1 L2 T1
Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

49.351G Nutrition  S2 L2 T1
Prerequisite: 49.350G or equivalent
Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group basis.

49.352G Advanced Nutrition  S2 L3 T3
Prerequisite: 49.351G or equivalent
Nutrition topics in relation to food and nutrition policy; the food industry and community nutrition in developing and industrialised countries; food enrichment, food allergies, supplementary feeding programs and nutrition education. Principles of the nutrient evaluation of foods. Practical sessions and computing using nutrient data bases.

49.450G Food Engineering Principles  S2 L2 T1
Prerequisites: First year mathematics and physics or equivalents
Units and dimensions, dimensionless groups, dimensional analysis; material and energy balances; steady state and unsteady state heat transfer; selection of insulation, heat exchangers and heat transfer equipment; refrigeration, freezing, filtration.

49.451G Unit Operations in Food Engineering  S2 L2 T2
Prerequisite: 49.450G or equivalent.
Food rheology, fluid flow, thermal properties of foods, evaporation, psychrometry, dehydration, extraction, size reduction, extrusion, measurement and control of process variables. Laboratory exercises in food rheology, fluid flow, heat transfer, evaporation, psychrometry, drying, instrumentation and process control.

49.452G Advanced Food Engineering  S2 L2 T2
Prerequisites: 49.451G, 49.453G or their equivalent.
Mathematical representation of heat and mass transfer and fluid mechanics in food processing. Numerical techniques and computer modelling; design of integrated food processing operations and process control; economics of process development and control; recent advances in food engineering.

49.453G Computing in Food Science  S2 L1 T1
Prerequisite: An introductory statistics subject or equivalent.
Introduction to VAX/VMS, VM/CMS, MS-DOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology.

49.454G Technology of Food Drying  S2 L2 T1

49.455G Food Engineering Laboratory  S2 T3
Co-requisite: 49.452G
Laboratory and pilot plant exercises illustrating the principles and procedures involved in food processing and food quality assessment.

49.456G Food Engineering Field Work  S1 T3
Inspection of food processing factories, agricultural and food research establishments and food producing areas.

49.457G Principles of Food Packaging  S1 or S2 L2 T1
Co-requisite: 49.152G
History of food packaging; chemical and physical properties of package materials; interaction between food and package; evaluation of packaging materials and systems; selection of packaging materials and systems; design criteria; laboratory work on physical properties of package materials and on evaluation of packaging materials and systems.
Department of Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

General

Units are offered separately subject to specified prerequisites as well as the restrictions on those units designed as bridging materials.

42.104G Graduate Seminars

42.111G Reading List in Biotechnology (Microbiology)

42.112G Reading List in Biotechnology (Biochemistry)

42.211G Principles of Biology SS L3

A study of the characteristics of living systems, including a functional treatment of cytology, metabolism, bioenergetics; structure, function and characteristics of single and multicellular organisms; growth; cell division; reproduction; heredity and evolution.

42.212G Principles of Biochemistry SS L3

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 anaerobic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, lipid 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 will be 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; computer/fermentor interactions. Industrial examples will be selected from: antibiotic and enzyme production, alcoholic beverages, single cell protein (SCP), microbial waste disposal and bacterial leaching. Tutorial/practical sessions include: problem solving, instrumentation, continuous culture techniques, and mathematical modelling and simulation of industrial processes.

42.215G Practical Biotechnology F T7

Illustration, demonstration and operation of laboratory-scale and pilot-scale equipment. Visits to appropriate industries. Experimental project or critical review.

42.281G Design of Microbial Reactors

Unit 1 Rate Processes

Bridging unit designed to provide the background in rate processes in heterogeneous systems required for Unit 3. This unit would 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 Introduction to 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 qualification 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 times and 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. Reacting 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, semibatch and continuous reactors; gas exchange balances. Rate processes in microbial flocs and microbial films. Design for microbial floc and film reactors.
42.282G Microbial Kinetics and Energetics

Unit 1 Microbial Kinetics

Prerequisite or co-requisite: 42.281G Unit 2 or equivalent.


Unit 2 Microbial Energetics

Prerequisite or co-requisite: 48.221G 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.

42.283G 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.

42.284G Heat, Mass and Momentum Transport

A bridging subject designed to provide an introductory understanding of the mechanisms of transport processes. This subject would 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.

42.401G Applied Genetics

Isolation of commercially useful microorganisms. Mutagenesis and the isolation of mutants of the following types: auxotrophs; catabolic mutants; feedback inhibition and repression resistance; constitutive; catabolite repression resistance; resistance to antimicrobial agents and to viruses; extended enzyme substrate specificity; altered enzyme properties; changes in promoter and attenuator activity.

Techniques of genetic exchange: transformation; conjugation; transduction; cell fusion; sexual and parasexual cycles. The use of these techniques in strain construction.


42.402G Peptide and Protein Technology

Industrial scale production of enzymes, peptide hormones, antibodies (including monoclonal antibodies), vaccines; regulation of synthesis by environmental control and genetic manipulation; recovery and downstream processing techniques; immobilization by entrapment and binding.

Applications of proteins in medical therapy and diagnosis and as analytical tools (including ELISA and affinity chromatography); applications of enzymes in the food and beverage industries.

42.403G Biochemical Engineering

Design of bioreactors; range of biocatalysts from free enzymes to immobilised cells; heat and mass transfer, scale-up, economic feasibility studies as applied to bioprocesses; design of equipment and facilities for sterile operation and to meet rec-DNA guidelines; downstream processing, design and operation; instrumentation and control; use of computer-linked systems; mathematical simulation.


42.404G Microbial Mineral Processing

Role of autotrophic and heterotrophic microbes in low-grade ore decomposition and pollution control. Microbial weathering of copper and iron sulphides, manganese oxides and silicates. Formation of manganese oxides.

The laboratory component includes column and shakeflask leaching studies on mined copper and manganese ores. Microbial physiology, enumeration and quantification of biological contributions in biohydrometallurgical processes.

42.405G Biodeterioration

42.406G Applied Cellular Physiology  SS L2T3
Elemental and molecular composition of cells; formulation of growth media; stoichiometry of growth processes and product formation; metabolic regulation; stringent response; mechanisms of metabolite uptake and product release; maintenance energy; thermodynamics of cellular growth and activities. Effect of mutation on cellular physiology; recombinant-DNA products. Fermentation processes: inoculum preparation, physiology of selected processes.

42.407G Biological Principles  SS L3

42.408G Bioengineering Principles  SS L3
A subject designed to provide an introductory course for students in the MAppSc (Biotech) program who have not previously undertaken any bioengineering studies.
Steady state and differential balances as a basis for quantification of complex real systems. Concepts in rate processes and kinetic analysis with application to biological systems. Experimental determination of rate data. Correlation of simple lumped rate processes and simultaneous distributed processes and the concepts involved in dimensionless numbers.
Lamina and turbulent flow. The structure of homogeneous and boundary layer turbulence flow in pipes and channels. Mixing theory. Process vessel (reactor) models.
Fluid viscosity, Newtonian and non-Newtonian fluids, convective and molecular transport processes. Heat and mass transport, film coefficients. Film, boundary layer, penetration and surface renewal theories (descriptive only).
Quantification of complex systems. Empirical and mechanistic models in biological systems.

42.501G Biotechnology Project (Major)  F T11
An experimental or technical investigation or design project in the general field of biotechnology.

42.502G Biotechnology Project (Minor)  F T3
A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.
School of Chemical Engineering and Industrial Chemistry
School of Chemical Engineering and Industrial Chemistry

Head of School
Professor D.L. Trimm

Administrative Officer
Mr P.B. Dunkley

The School contains the Departments of Chemical Engineering and Industrial Chemistry which service two degree courses, and the Departments of Fuel Technology and Polymer Science which offer professional electives in these degree courses. A professional elective in Biological Process Engineering is also available from the Department of Biotechnology.

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

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

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 Chemical Engineering must obtain a minimum of twelve weeks' professionally oriented or industrial experience.

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.
Staff

Professor of Chemical Technology and Head of School
David Lawrence Trimm, BSc PhD Exe., DIC Lond., CEng, FRACI, FIChemE

Professor of Chemical Engineering (and Dean, Faculty of Engineering from 1/1/89)
Christopher Joseph Dalzell Fell, BSc N.S.W., PhD Camb., CEng, FIChemE, FIE Aust, MAmerIChE

Professor of Petroleum Engineering
Val Wolf Pinczewski, BE N’cle (N.S.W.), PhD N.S.W., CEng, MIChemE

Associate Professors
Anthony Gordon Fane, BSc PhD DIC Lond., CEng, MIChemE
John Kingsford Haken, MSc PhD N.S.W., ASTC, FRACI
Maria Skylax Kazacos, BSc PhD N.S.W., ARACI, MES
Geoffrey David Sergeant, BSc PhD Wales, CEng, FInstE, FAIE
Mark Sebastian Wainwright, MApSc Adel., PhD McM., MAmerIChE, FRACI, MIE

Senior Lecturers
Michael Paul Brungs, BSc PhD N.S.W.
John Buchanan, ME Syd., PhD N.S.W.
Robert Paul Burford, BSc PhD Adel., FPRI, MAmerIChE, ARACI
Rodney Philip Chaplin, BSc PhD Adel., ARACI
Douglas Christopher Dixon, BE MEngSc Syd., PhD N.S.W., MIE Aust
Neil Russell Foster, BSc PhD N.S.W., MAmerIChE, ARACI
Brian David Henry, MSc N.S.W., PhD Lough., CEng, FIChemE, MIE Aust

Lecturers
John Clifford Jones, BSc PhD Leeds, ARACI, CChem
William Patrick Walsh, BSc PhD Syd.

Administrative Officer
Philip Brian Dunkley, BA DipEd N.S.W.

Professional Officers
Robert Edmund Brand, BSc BE N.S.W., ASTC, ARACI
Stephen Joseph Clough, BSc Syd., MApSc N.S.W., CChem, ARACI, MAIE
Barry William Edenborough, BE PhD N.S.W.
Ashley John Deacon, BAppSci N.S.W.I.T.
Crest Dworjanyn, MSc N.S.W., ASTC, ARACI
David John Kelly, BSc BE Syd., MEngSc N.S.W.
Cyril Leslie Samways, BSc Syd., MSc N.S.W.

Department of Chemical Engineering

Head
Associate Professor M.S. Wainwright

Department of Fuel Technology

Head
Associate Professor G. D. Sergeant

Department of Industrial Chemistry

Head
Professor D. L. Trimm

Department of Polymer Science

Head
Associate Professor J. K. Haken

Centre for Petroleum Engineering Studies

(Director to 31/12/88)
Professor V. W. Pinczewski

Senior Lecturer
Henry Alfred Salisch, BSc Quito Poly. Inst., MSc Oklahoma, MS Venezuela Central

Lecturer
Juan Carlos Mantegon, ME PhD Buenos Aires

Visiting Professors
M Rasin Tek, PhD Mich.
Charles S Aldrich, BSE Texas, MSE Colorado Sch. of Mines

Centre for Membrane and Separation Technology

(Director to 31/12/88)
Professor C.J.D. Fell
## Course Outlines

### Undergraduate Study

**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 Royal Australian Chemical Institute as sufficient academic qualification for corporate membership.

The revised new course commences in 1988 with prefix 3, and the old course with prefix 48, for Chemical Engineering subjects will be phased out over the next two to three years.

Various course patterns involving full-time or part-time study may be approved by the Head of School. Evening classes are only available in most Year 1 subjects.

### Year 1 (New Course)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>1.001</td>
<td>Physics 1</td>
<td>6.6</td>
</tr>
<tr>
<td>2.121</td>
<td>Chemistry 1A and</td>
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</tr>
<tr>
<td>2.131</td>
<td>Chemistry 1B or</td>
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<td>Chemistry 1M</td>
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<tr>
<td>3.110</td>
<td>Introduction to Chemical Engineering</td>
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<td>5.0011</td>
<td>Engineering Mechanics I</td>
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<tr>
<td>5.0302</td>
<td>Engineering Drawing and Descriptive Geometry</td>
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<tr>
<td>10.001</td>
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<td>Physical Chemistry</td>
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<td>2.102E</td>
<td>Organic and Inorganic Chemistry (for Chemical Engineers)</td>
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<td>3.021</td>
<td>Instrumental Analysis</td>
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<td>3.022</td>
<td>Computing</td>
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<td>3.121</td>
<td>Material and Energy Balances</td>
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<tr>
<td>3.122</td>
<td>Flow of Fluids</td>
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<td>3.123</td>
<td>Heat Transfer</td>
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<td>3.124</td>
<td>Chemical Engineering Laboratory I</td>
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<tr>
<td>3.125</td>
<td>Materials and Corrosion</td>
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**Total:**

| Hours per week | 23.52 |

### Year 3 (New Course)

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<tr>
<td>3.032</td>
<td>Reaction Engineering</td>
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<td>3.033</td>
<td>Numerical Methods</td>
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<td>3.034</td>
<td>Process Control</td>
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<td>3.131</td>
<td>Fluids II</td>
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<tr>
<td>3.132</td>
<td>Mass Transfer and Separation</td>
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<td>3.133</td>
<td>Particle Mechanics</td>
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<td>3.134</td>
<td>Process Plant Engineering I</td>
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<td>3.135</td>
<td>Chemical Engineering Laboratory II</td>
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<td>3.136</td>
<td>Chemical Engineering Applications(*)</td>
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<td>8.6110</td>
<td>Structures</td>
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**Total:**

| Hours per week | 25.52 |

(*Students electing to take a coherent Fuel Engineering Elective over years 3 and 4 take 3.331 Fuel Engineering I in lieu of 3.136)

### Year 4 (New Course)

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<td>3.141</td>
<td>Process Dynamics and Control</td>
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<td>3.142</td>
<td>Advanced Reaction Engineering (*)</td>
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<tr>
<td>3.143</td>
<td>Multicomponent Separation</td>
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<td>3.144</td>
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<td>3.145</td>
<td>Safety and Environmental</td>
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<td>3.146</td>
<td>Process Plant Operation [*]</td>
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<tr>
<td>3.147</td>
<td>Management</td>
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<td>3.148</td>
<td>Design Project</td>
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<td>3.149</td>
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**Total:**

| Hours per week | 25.0 |


### Year 3 (Old Course)

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<td>0.3</td>
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<tr>
<td>8.6110</td>
<td>Structures</td>
<td>3.0</td>
</tr>
<tr>
<td>10.032</td>
<td>Mathematics</td>
<td>2.2</td>
</tr>
<tr>
<td>48.031</td>
<td>Chemical Engineering 2A</td>
<td>7.0</td>
</tr>
<tr>
<td>48.032</td>
<td>Chemical Engineering 2B</td>
<td>0.6</td>
</tr>
<tr>
<td>48.033</td>
<td>Chemical Engineering 2C</td>
<td>0.6</td>
</tr>
<tr>
<td>48.036</td>
<td>Chemical Engineering Laboratory 1</td>
<td>2.2</td>
</tr>
<tr>
<td>48.135</td>
<td>Thermodynamics</td>
<td>3.0</td>
</tr>
<tr>
<td>48.136</td>
<td>Reactor Design 1</td>
<td>1.2</td>
</tr>
<tr>
<td>48.163</td>
<td>Instrumentation and Process Control</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>General Education subject</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Total:**

| Hours per week | 20.26 |

Plus one or more of the following electives to total 84 hours for the year.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.734</td>
<td>Mineral Process Engineering</td>
<td>3.0</td>
</tr>
<tr>
<td>48.0391</td>
<td>Electrochemical Engineering</td>
<td>3.0</td>
</tr>
</tbody>
</table>

| Hours per week | 35.0 |
Students should take these subjects at equivalent stages of the part-time degree.

Students enrolled in this BE BSc degree course will be awarded their degrees at the conclusion of five years study. Distinguished performance over five years may lead to the award of Honours. Years 1 to 4 of the course are equivalent to the first four years of the Chemical Engineering Course 3040.

**Fuel Engineering**

The Department of Fuel Technology offers a coherent professional elective 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 elective covers 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 choosing this professional elective should take 48.331 Fuel Engineering 1 in Year 3 and 48.341 Fuel Engineering 2 and 48.340 Fuel Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree.

This elective may qualify graduates for membership of the Australian Institute of Energy and the Institute of Energy (UK).

**Professional Electives in Course 3040**

**Chemical Engineering**

Students wishing to pursue a career in the chemical, petrochemical, minerals utilization or metallurgical industries are advised to take 48.039 Chemical Engineering 2J in Year 3 and two of 7.745 Mineral Chemistry, 48.113 Chemistry of Industrial Processes, 48.403 Polymer Science 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.

**Biological Process Engineering**

The Department of Biotechnology offers a coherent professional elective in Biological Process Engineering designed for students wishing to pursue a career in the biologically based processing industries. Students electing for this professional elective should take 4.101 Introductory Microbiology in Year 3, and 48.311 Biological Process Engineering and 48.240 Biological Process Engineering Project in Year 4.

---

**Applied Science**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.0393</td>
<td>Computer Simulation</td>
<td>0,3</td>
</tr>
<tr>
<td>44.101**</td>
<td>Introductory Microbiology</td>
<td>6,0</td>
</tr>
<tr>
<td>48.321</td>
<td>Fuel Engineering</td>
<td>3,3</td>
</tr>
</tbody>
</table>

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 4 (Old Course)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>48.041</td>
<td>Chemical Engineering 3A</td>
<td>4,0</td>
</tr>
<tr>
<td>48.042</td>
<td>Chemical Engineering 3B</td>
<td>4,0</td>
</tr>
<tr>
<td>48.043</td>
<td>Chemical Engineering 3C</td>
<td>3,2</td>
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<tr>
<td>48.044</td>
<td>Chemical Engineering Laboratory 2</td>
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<td>48.047</td>
<td>Chemical Engineering 3D Project*</td>
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<tr>
<td></td>
<td></td>
<td>1,11</td>
</tr>
</tbody>
</table>

The project is selected from:

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

Plus one or more of the following to total 168 hours for the year:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>4.934</td>
<td>Designing with Advanced Materials</td>
<td>3,3</td>
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<tr>
<td>7.746</td>
<td>Mineral Process Chemistry</td>
<td>6,6</td>
</tr>
<tr>
<td>48.113</td>
<td>Chemistry of Industrial Processes</td>
<td>3,3</td>
</tr>
<tr>
<td>42.105</td>
<td>Biological Processes Engineering</td>
<td>6,6</td>
</tr>
<tr>
<td>48.331</td>
<td>Fuel Engineering 3</td>
<td>6,6</td>
</tr>
<tr>
<td>48.403</td>
<td>Polymer Science</td>
<td>3,3</td>
</tr>
<tr>
<td>48.046</td>
<td>Chemical Engineering Projects</td>
<td>6,6</td>
</tr>
</tbody>
</table>

Any other elective approved by Head of School

**3129 Combined Degree in Chemical and Mineral Engineering — Full-time Course**

**Bachelor of Engineering/Bachelor of Science.**

**BE BSc**

This combined degree course of five years full-time study enables a student from the School of Chemical Engineering to qualify for the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc). The course enables such combined degree students to major in the areas of mineral processing and extractive metallurgy. It is jointly offered by the School of Chemical Engineering and Industrial Chemistry and the Department of Mineral Processing and Extractive Metallurgy, and is administered by the Faculty of Applied Science.

A part of the requirement for this double degree will be an 8 week Vacation Work Experience in the mineral industry during the summer vacation, at the end of the fourth year in Chemical Engineering.

Students enrolled in this BE BSc degree course will be awarded their degrees at the conclusion of five years study. Distinguished performance over five years may lead to the award of Honours. Years 1 to 4 of the course are equivalent to the first four years of the Chemical Engineering Course 3040.

Students must have completed the BE course in Chemical Engineering with the Mineral Subjects in Years 3 and 4 (i.e. including a Year 4 project which is minerals oriented) to have the opportunity to enrol in Year 5 which is set out below.
### Year 5

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td>7.622/2 Mineral Engineering I Unit 2</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>7.632 Mineral Engineering II</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>7.642 Mineral Engineering III</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>7.643 Mineral Engineering Projects and Laboratory</td>
<td>S1 6, S2 9</td>
</tr>
<tr>
<td>25.520 Geology for Mining Engineers</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>25.523 Mineralogy</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.142 Mine Development</td>
<td>S1 1, S2 1</td>
</tr>
<tr>
<td>7.113 Mining Methods</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 25, S2 25</strong></td>
</tr>
</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.030 Organic Chemistry</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>48.113 Chemistry of Industrial Processes</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>48.121 Corrosion in the Chemical Industry</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.135 Thermodynamics</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>48.136 Reactor Design I</td>
<td>S1 1, S2 2</td>
</tr>
<tr>
<td>48.137 Industrial Chemistry 2A</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>48.138 Industrial Chemistry 2B</td>
<td>S1 0, S2 3</td>
</tr>
<tr>
<td>48.139 Experimental Design</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.163 Instrumentation and Process Control 1</td>
<td>S1 0, S2 3</td>
</tr>
<tr>
<td>48.171 Chemistry of High Temperature Materials</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.172 Instrumental Analysis 2</td>
<td>S1 4, S2 0</td>
</tr>
<tr>
<td>48.403 Polymer Science</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 24, S2 22</strong></td>
</tr>
</tbody>
</table>

### Year 4

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.1211 Production Management A</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>42.114 Fermentation Processes</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.0471 Management</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.124 Applied Kinetics</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.134 Applied Thermodynamics</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.165 Laboratory Automation Science</td>
<td>S1 0, S2 4</td>
</tr>
<tr>
<td>48.174 Seminars</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>48.194 Project</td>
<td>S1 0, S2 16</td>
</tr>
<tr>
<td>48.404 Advanced Polymer Science</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 25, S2 24</strong></td>
</tr>
</tbody>
</table>

Plus one of the following:*  

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.115 Industrial Electrochemistry</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>48.116 Water Chemistry</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>48.166 Microprocessors in Analytical Instrumentation</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>48.303 Fuel Science for Industrial Chemists</td>
<td>S1 2, S2 0</td>
</tr>
</tbody>
</table>

*Only one of these is offered in any one year as selected by student preferences.

### Year 2

**Revised Year 2 Industrial Chemistry**

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9222 Electronics</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>2.102A Physical Chemistry</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>2.102C Inorganic Chemistry</td>
<td>S1 0, S2 6</td>
</tr>
<tr>
<td>2.102B Organic Chemistry</td>
<td>S1 2, S2 4</td>
</tr>
<tr>
<td>10.031 Mathematics</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>10.301 Statistics SA</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>48.122 Instrumental Analysis</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>3.220 Introduction to Fluid Flow</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>3.221 Mass and Energy Balances</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>3.222 Heat Transfer and Temperature Measurement</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>3.022 Computing</td>
<td>S1 1½, S2 1½</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 25½, S2 23½</strong></td>
</tr>
</tbody>
</table>

### 3110 Industrial Chemistry — Part-time Course

**Bachelor of Science (Technology) BSc(Tech)**

<table>
<thead>
<tr>
<th>Stages 1 and 2*</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001 Physics 1</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>2.121 Chemistry 1A and</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>2.131 Chemistry 1B</td>
<td>S1 0, S2 6</td>
</tr>
<tr>
<td>3.210 Industrial Chemistry 1</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>10.001 Mathematics</td>
<td>S1 0, S2 6</td>
</tr>
</tbody>
</table>

---

**Undergraduate Study: Course Outlines**

- **Years**
- **Hours per week**
  - S1
  - S2

---

**3100 Industrial Chemistry — Full-time Course**

- **Bachelor of Science BSc**
- **To accommodate changes in the Chemical Engineering course minor changes will take place in the Industrial Chemistry course from 1988 onwards.**

**Year 1**

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001 Physics 1</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>2.121 Chemistry 1A and</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>2.131 Chemistry 1B</td>
<td>S1 0, S2 6</td>
</tr>
<tr>
<td>2.141 Chemistry 1M</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>10.001 Mathematics</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>3.210 Industrial Chemistry 1</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>5.0011 Engineering Mechanics 1</td>
<td>S1 0, S2 4</td>
</tr>
<tr>
<td>17.031 Biology A or</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>25.110 Earth Materials and Processes</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>5.0302 Engineering Drawing and Descriptive Geometry</td>
<td>S1 4, S2 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 24, S2 24</strong></td>
</tr>
</tbody>
</table>

---

**Year 2**

- **Revised Year 2 Industrial Chemistry**

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9222 Electronics</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>2.102A Physical Chemistry</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>2.102C Inorganic Chemistry</td>
<td>S1 0, S2 6</td>
</tr>
<tr>
<td>2.102B Organic Chemistry</td>
<td>S1 2, S2 4</td>
</tr>
<tr>
<td>10.031 Mathematics</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>10.301 Statistics SA</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>48.122 Instrumental Analysis</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>3.220 Introduction to Fluid Flow</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>3.221 Mass and Energy Balances</td>
<td>S1 2, S2 0</td>
</tr>
<tr>
<td>3.222 Heat Transfer and Temperature Measurement</td>
<td>S1 0, S2 2</td>
</tr>
<tr>
<td>3.022 Computing</td>
<td>S1 1½, S2 1½</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>S1 25½, S2 23½</strong></td>
</tr>
</tbody>
</table>

---

**3110 Industrial Chemistry — Part-time Course**

- **Bachelor of Science (Technology) BSc(Tech)**

**Stages 1 and 2**

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001 Physics 1</td>
<td>S1 6, S2 6</td>
</tr>
<tr>
<td>2.121 Chemistry 1A and</td>
<td>S1 6, S2 0</td>
</tr>
<tr>
<td>2.131 Chemistry 1B</td>
<td>S1 0, S2 6</td>
</tr>
<tr>
<td>3.210 Industrial Chemistry 1</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>10.001 Mathematics</td>
<td>S1 0, S2 6</td>
</tr>
</tbody>
</table>
Centre for Petroleum Engineering Studies

The Centre of Petroleum Engineering has a four-year course leading to the award of a Bachelor of Engineering in Petroleum Engineering.

The first two years of the Petroleum Engineering Course are identical to the first two years of the Chemical Engineering Course. The University has approved an arrangement whereby, upon recommendation of the Head of School, students who satisfy the requirements of the first two years of the Mechanical Engineering, Civil Engineering or Mining degree course at the University may be admitted into the final two years of the BE degree course in Petroleum Engineering. Such students would complete an appropriately modified Year 3 program as approved by the Head of School.

The University has also approved an arrangement whereby, upon the recommendation of the Head of School, students who satisfy the requirements of the first two years of the Chemical, Mechanical, Civil or Mining Engineering full-time degree courses at any other Australian tertiary institution may be admitted to the final two years of the Petroleum Engineering course. Such students will be required to undertake an appropriately modified Year 3 program as approved by the Head of School. Acceptance into the course will be on the basis of academic merit.

3045
Petroleum Engineering — Full-time Course
Bachelor of Engineering
BE

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
<tr>
<td>6.854</td>
<td>Electrical Power Engineering</td>
</tr>
<tr>
<td>8.6110</td>
<td>Structures</td>
</tr>
<tr>
<td>10.032</td>
<td>Mathematics</td>
</tr>
<tr>
<td>20.301</td>
<td>Properties and Phase Behaviour of Petroleum Reservoir Fluids</td>
</tr>
<tr>
<td>20.302</td>
<td>Reservoir Rock Properties and Fluid Flow in Porous Media</td>
</tr>
<tr>
<td>20.303</td>
<td>Well Drilling and Completions</td>
</tr>
<tr>
<td>20.304</td>
<td>Reservoir Engineering 1</td>
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<tr>
<td>20.305</td>
<td>Drilling and Production Lab</td>
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<tr>
<td>20.306</td>
<td>Petroleum Production Economics</td>
</tr>
<tr>
<td>20.307</td>
<td>Petroleum Thermodynamics</td>
</tr>
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<td>Physical Geology for Petroleum Engineers 1</td>
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<tr>
<td>25.5332</td>
<td>Physical Geology for Petroleum Engineers 2</td>
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<tr>
<td>25.5302</td>
<td>Structural Geology</td>
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<td>Mass Transfer and Separation</td>
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Stage 3

<table>
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<td>10.032</td>
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<td>20.302</td>
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<td>3.132</td>
</tr>
<tr>
<td>3.034</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Graduate Study

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 degree 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:

Chemical Engineering and Industrial Chemistry
- Course 8015

Fuel Technology
- Course 8060

Petroleum Engineering
- Course being arranged

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 and Industrial Chemistry, Fuel Technology and Petroleum Engineering are primarily intended for graduates in Applied Science, Engineering, or Science with principal interests in Chemistry, Mathematics and/or Physics. 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 18 hours weekly for two sessions full-time or 9 hours weekly for four sessions part-time, and which could comprise:

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 and Industrial Chemistry. 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.

Courses will be run in any year only if sufficient applications are received. A minimum number of 5 registrations is usually required.

8015
Chemical Engineering and Industrial Chemistry Graduate Course

Master of Applied Science MAppSc

This course is designed to allow students to select areas of specialization appropriate to their needs. The areas of specialization include Industrial Chemistry, Chemical Engineering and Industrial Pollution Control. Students are asked to consult the area supervisors in the School to develop a program of study which complies with regulations for the Master of Applied Science degree. Students may undertake a Major Project (48.900G) amounting to six hours per week for a year or take a Minor Project (48.901G) of three hours per week for a year and select an extra elective subject.

8060
Fuel Technology Graduate Course*

Master of Applied Science MAppSc

This is 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 subject 3.331 can comprise the undergraduate component, the project (30% or 15% of the program) is 3.900G or 3.901G, and the remainder of the hours can be taken from the units offered in the 3.38G and 3.39-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.

Centre for Petroleum Engineering

The Centre offers courses that cover the areas of Reservoir Engineering, Production Engineering and Formation Evaluation. Suggested course outlines are available from the Director of the Centre.

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 and is offered every second year.

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 may be necessary.

Year 1 of the course introduces elementary aspects of corrosion technology and suitably orientates students depending on their initial qualifications. Year 2 of the course contains more detailed instruction at a graduate level in corrosion theory and prevention, together with a suitable project.

*For additional information on the MAppSc degree course see earlier this section.

Year 1

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.121</td>
<td>Corrosion in the Chemical Industry</td>
<td>0</td>
</tr>
<tr>
<td>48.180G</td>
<td>Corrosion Materials</td>
<td>2</td>
</tr>
<tr>
<td>48.181G</td>
<td>Industrial Coatings for Corrosion</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Protection</td>
<td></td>
</tr>
</tbody>
</table>

Centre for Petroleum Engineering

The oil industry traditionally employs personnel who, although working as Petroleum Engineers, have no formal qualifications in petroleum engineering. The Diploma Program in Petroleum Engineering is designed to provide these people with a means of obtaining formal qualifications in a short intensive full-time study program over one academic year.

The course work, carried out under the guidance and supervision of academic staff of the Centre, and in close co-operation with the oil industry, will incorporate a significant percentage of practical work in major areas of petroleum engineering. At the end of the formal course, satisfactory completion of a two-months practical assignment in the oil industry will be required, for the diploma to be awarded.

Candidates for the program must hold a Bachelors Engineering or Science Degree and some relevant field experience in the industry. Acceptance into the program is at the discretion of the Director of Centre for Petroleum Engineering.

The one year (two session) program course consists of the following subjects:

Session 1

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.302</td>
<td>Reservoir Rock Properties</td>
<td>2</td>
</tr>
<tr>
<td>20.303G</td>
<td>Well Drilling &amp; Completions</td>
<td>3</td>
</tr>
<tr>
<td>20.303SG</td>
<td>Drilling &amp; Production Lab.</td>
<td>3</td>
</tr>
<tr>
<td>Subject Code</td>
<td>Subject</td>
<td>Hours Per Week</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>20.403G</td>
<td>Production Engineering</td>
<td>3</td>
</tr>
<tr>
<td>20.410G</td>
<td>Well Pressure Testing</td>
<td>2</td>
</tr>
<tr>
<td>20.411G</td>
<td>Formation Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>25.5331</td>
<td>Physical Geology for Petroleum Engineering I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total:** 18

### Session 2

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.301</td>
<td>Properties and Phase Behaviour</td>
<td>2</td>
</tr>
<tr>
<td>20.306G</td>
<td>Petroleum Production Economics</td>
<td>1</td>
</tr>
<tr>
<td>20.309G</td>
<td>Reservoir Engineering</td>
<td>2</td>
</tr>
<tr>
<td>20.406G</td>
<td>Reservoir Simulation Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>20.409G</td>
<td>Petroleum Engineering Project</td>
<td>6</td>
</tr>
<tr>
<td>20.411G</td>
<td>Formation Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>25.5332</td>
<td>Physical Geology for Petroleum Engineering II</td>
<td>3</td>
</tr>
<tr>
<td>20.501G</td>
<td>Practical Assignment*</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total:** 19

*Two months practical assignment taken at end of formal course.*
Subject Descriptions

Undergraduate Study

Centre for Petroleum Engineering

20.301 Properties and Phase Behaviour of Petroleum Reservoir Fluids  
S1  L3
Chemical, physical and thermodynamic properties of petroleum and reservoir fluids. Phase behaviour of multicomponent hydrocarbon systems. Use of computers to predict complex phase behaviour, real gas law, liquid mixtures, flash calculations, pressure, volume and temperature calculations for reservoir fluids. Application of these concepts to the prediction of gas and gas-condensate reservoir behaviour.

S1  L3

20.303 Well Drilling and Completions  
S2  L3
Well drilling methods and elements of rock mechanics. Rheology of Newtonian and non-Newtonian fluids, chemical properties and carrying capacity of drilling fluids, rotary drilling hydraulics, bit hydraulics and factors affecting rate of penetration. Prediction and control of abnormal pressures. Casing and tubing design, principles of cementing, well completion materials, well perforating, equipment and operative standards, acidizing, fracturing, problem well analysis and remedial treatment design.

20.304 Reservoir Engineering I  
S2  L3
Prerequisite: 20.301, 20.302.
Classification of reservoirs by type and recovery mechanism, reserve and production rate estimates based on material balance calculations. Introduction to displacement processes in petroleum reservoirs. Design of reservoir development.

20.305 Drilling and Production Lab  
S2  L3
Properties of drilling fluids. The design, composition and measurement of the properties of drilling fluids. Measurement of basic rock properties such as porosity, permeability and capillary pressure.

20.306 Petroleum Production Economics  
S1  L1
Basic elements of profitability analysis. Depreciation, financial statements, interest, time value of money. The financial plant, outside share, planning and scheduling, pricing and costs. Profitability. Criteria, applications of present value profiles, risk and risk adjustment.

20.307 Petroleum Thermodynamics  
S1  L2T1

20.308 Formation Evaluation 1  
F  L2

20.401 Reservoir Engineering II  
S1  L3
Prerequisite: 20.304.
Basic unsteady-state flow for single phase fluids in porous media. Diffusivity equation and solutions. Application to practical well test analysis methods. Pressure build-up, drawdown, interference and pulse testing to evaluate reservoir properties. Extension to multiphase flows and introduction to displacement processes in petroleum reservoirs.

20.402 Reservoir Fluids Laboratory  
S1  L3
Prerequisite: 20.301.
Physical properties of petroleum and its products, gravity, viscosity, surface tension, chromatography. PVT analysis of reservoir fluids.

20.403 Production Engineering  
S1  L3
Prerequisite: 20.304

20.404 Formation Evaluation 2  
F  L2
Prerequisite: 20.308
20.405 Oil and Gas Law and Regulation  S1 L2

20.406 Reservoir Simulation Fundamentals  S2 L3
Prerequisite: 20.401, 10.032, 48.032.

20.407 Advanced Recovery Mechanisms  S2 L3
Prerequisite: 48.041, 20.401.

20.408 Natural Gas Engineering  S2 L3

20.409 Petroleum Engineering Project  S14 S2 L11
A major design or research project on a problem relevant to petroleum engineering and concluding in the submission of an individual thesis. Projects of relevance to the research efforts in the School plus approved topics of particular interest to industry.

20.410 Well Pressure Testing  S1 L2
Theory of transient well testing. Practical aspects of design and performance of field tests. Analysis of transients pressure data, effects of boundaries, reservoir heterogeneity, multiphase flow. Study of production, DST and formation interval tests. Pulse testing and multi-well tests. Computer assisted well test analysis techniques.

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 6th 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.

3.021 Instrumental Analysis  FL1T2

3.210 Industrial Chemistry I  FL1T1
Introduction to the chemical industry. The role of the industrial chemist in society. The ethical responsibility of the industrial chemist. Introduction to materials for the chemical industry. Information retrieval. Communication skills. Factory visits.


3.022 Computing  FL1T½
Prerequisite: 10.001
Computing for technical applications. Operating systems: VAX computers, the VMS operating system and the EDT editor. The FORTRAN language Elementary numerical methods; library subprograms; structures of program modules for technical calculations. The BASIC language.

3.031 Engineering Thermodynamics  S1 L2T1 S2L1
Co or Prerequisite: 2.102A
3.032 Reaction Engineering


3.033 Numerical Methods


3.034 Process Control


3.110 Introduction to Chemical Engineering

Introduction to the processing industry and chemical engineering practice. The role and responsibilities of the chemical engineer. Introduction to materials of construction for the processing industries. Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids.

3.121 Material and Energy Balances


3.122 Flow of Fluids


3.123 Heat Transfer


3.124 Chemical Engineering Laboratory I

An introduction to laboratory work in chemical engineering including information retrieval techniques.

3.125 Materials and Corrosion


3.131 Fluids 2


3.132 Mass Transfer and Separation


3.133 Particle Mechanics S2L2T1
Prerequisite: 3.122


3.134 Process Plant Engineering 1 FL2T1
Prerequisites: 3.121, 3.122, 3.123

Processing Engineering I: All activities required from the conception of the idea to produce a product through to the finalisation of the process flow diagram including process selection and evaluation, process design, process simulation, process representation, process acquisition and licensing. Project Engineering I: Outline of scope of a process plant including plant location and layout, processing facilities and offsets including utility system design, statutory regulations, facilities for storage, processing and transport of materials within the plant including design of piping systems. Process Equipment Design: Procedures for the selection, design, specification and representation of process equipment. Pressure vessel and heat exchanger design. Engineering standards and procedures. Process Economics I: Capital and operating costs of a process plant. Fixed and variable costs. Break-even analysis. Cost estimation methods.

3.135 Chemical Engineering Laboratory 2 FT 1½
Prerequisites: 2.102A, 3.021, 3.022, 3.121, 3.122, 3.123, 3.124

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat transfer, mass transfer, thermodynamics and kinetics, instrumentation and process dynamics and control. The objectives of this laboratory are: to demonstrate, reinforce and extend the principles of chemical engineering which are covered elsewhere in the course; 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.

3.136 Chemical Engineering Applications F L2T2
Prerequisites: 2.102A, 3.121, 3.122, 3.123

Application of chemical engineering principles of biotechnology, fuel engineering and minerals processing and extractive metallurgy. Integrated problem illustrating skills in process analysis. Lectures in this subject will given by staff drawn by agreement from appropriate Schools.

3.140 Research Project FT6
Prerequisites: Successful completion of all Year 3 subjects.

The experimental investigation of some aspect of chemical engineering.

3.141 Process Dynamics and Control S1L2T1 S2L1T1
Prerequisites: 3.033, 3.034

Common types of feedback controllers; translating control problems into block diagrams. Closed loop relationships and response; stability analysis for SISO systems; feedback controller tuning. Open and closed loop dynamic behaviour of systems of different order and how best to control these systems. Effect of dead time on control; introduction to dead time compensation. Introduction to cascade, feed forward and ratio control. Application of digital computers to real time control; interfacing computers with processes; distributed control systems; data acquisition and process monitoring; digital implementation of control algorithms. Introduction to multivariable control.

3.142 Advanced Reaction Engineering S1L1T1
Prerequisite: 3.032


3.143 Multicomponent Separation Processes S2L1T1
Prerequisite: 3.132


3.144 Process Plant Engineering 2 S1L2T2
Prerequisite: 3.134

3.145 Safety and Environmental S1L2
Prerequisite: 3.134

3.146 Process Plant Operation S1L1T2
Practical studies of the operation of computer controlled chemical plant. Process diagnostics. Troubleshooting.

3.147 Management S2L2
A workshop comprising exercises and case studies to introduce the human and organizational aspects of managing process or engineering enterprises. Includes discussion of typical organizational structures and reasons for choosing them; problems of managing people in organizations, industrial relations questions.

3.148 Design Project S1T1 S2T4
This project will cover the engineering of a small process plant or part thereof requiring the application of material covered within the undergraduate course. The minimum requirements of this project are as specified by the relevant engineering institution's accreditation standards.

3.149 Professional Electives FL2T2
To be chosen from offerings yet to be finalised in:
- Biochemical Engineering
- Industrial Chemistry
- Minerals Science and Engineering
- Materials Processing and Extractive Metallurgy
- Polymer Science
which will be offered by the relevant Schools or Departments.

3.220 Introduction to Fluid Flow S1 L1 T1
Prerequisites: 1.001, 10.001
Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation, continuity, Bernoulli's equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow, and losses due to friction. Measurement in Fluid Mechanics; viscosity, pressure, velocity, flowrate.

3.221 Mass and Energy Balances S1 L1 T1
Prerequisites: 2.121, 3.110, 10.001

Students not taking 3.110 will be required to complete a 28 hour bridging course offered by the School early in Session 1.

3.222 Heat Transfer and Temperature Measurement S2 L1 T1
The course will deal with conduction, convection and radiation. Conduction will cover Fourier's Law and the thermal resistance concept. Convection will deal with passage of fluid over a surface and the importance of the Reynolds number in calculating the convection heat transfer coefficient. Radiation will deal with blackbody radiation and Stefan's Law. Applications to industrial heat transfer equipment will be discussed.

Temperature measurement devices and circuits. Pyrometry.

3.331 Fuel Engineering 1 FL3T1

3.340 Fuel Research Projects S1T6 S2T6
The experimental investigation of some aspect of fuel engineering.

3.341 Fuel Engineering 2 S1LST4 S2LST2

48.025 Chemical Engineering for Ceramic Engineers
Consists of Units 1 and 3 of 48.022.

48.031 Chemical Engineering 2A
Unit 1 Mass Transfer (Theory) S1 L1T1
Prerequisites: 2.102A, 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 equilibrium 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 2 (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

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 and 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


Unit 5 Safety and Failure Tolerance

Co-requisite: 48.031 Unit 4.

Unit 6 Economics


48.032 Chemical Engineering 2B

Unit 1 Solids Handling

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 Computation 2

Prerequisites: 10.301 or 10.031, 48.022 Unit 2.
Extends material given in Computation 1, and places emphasis on efficient use of FORTRAN AND BASIC, and use of job control language, files and programme packages. Numerical methods are considered for solving linear and non-linear algebraic equations, systems of linear equations (in particular those connected with regression analysis), ordinary and partial differential equations and simple optimization problems. Examples will be drawn from problems arising in chemical process industries; these applications will include formulation and solution of computer models of physical processes, and analysis of laboratory and plant results and fitting of empirical equations to data.

Unit 3 Engineering Thermodynamics

Engineering applications of thermodynamics. Heat engines, refrigeration.

Unit 4 Agriculture Economics 2

Prerequisite: 48.031 Unit 6.

Unit 5 Surface Separation Processes

Prerequisite: 48.031 Unit 1.
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.

48.033 Chemical Engineering 2C

Unit 1 Mass Transfer (Design)

Prerequisite: 48.031 Unit 1.
The design of equipment for absorption, distillation and liquid-liquid extraction. Selection of column types. Design of sieve and other types of plate for plate columns. Design of packed columns. Performance characteristics of plate and packed col-
The design of plant for the production of chemicals and the
48.040 Chemical Engineering Project S1 T1 S2 T11
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 3A
Prerequisite: 48.031.
Unit 1 Convective Mass Transfer S1 L1
Models for convective mass transfer are fixed and free interfaces. Calculation of mass transfer rates at surfaces with simple
gas or liquid medium. Mass transfer in dispersions and in systems involving
chemical reaction.

Unit 2 Simultaneous Heat and Mass Transfer S1 L1
Psychometry, principles of design calculations for cooling towers and for humidification operations. Topics selected from:
drying of solids, crystallization, sublimation, gasliquid and thermal diffusion.

Unit 3 Multicomponent Separation S1 L1
The separation of multicomponent systems by stage-wise operations. Brief review of conventional graphical calculation meth-
ods leading to a graphical treatment of ternary distillation. Multicomponent separations using modern computer tech-
niques. Phase equilibrium relationships for liquid-vapour and liq-
uid-liquid systems. Azeotropes and azeotropic distillation.

Unit 4 Transport Phenomena S1 L1
A generalized treatment of the continuum approach to momentum, energy and mass transport. Application of the conserva-
tion equations to chemical engineering problems. Discussion of the advantages and limitations of the transport approach.

48.042 Chemical Engineering 3B
Prerequisites: 10.032, 48.163.
Unit 1 Process Dynamics and Control 1 S1 L2T1
Analysis of dynamic systems: derivation of equations for lumped parameter systems, linearization, reduction to transfer func-
tions, numerical solutions. Control hardware: basic measuring instruments, control valves, analog controllers, digital computer-
based controllers. Process control: analysis and synthesis of single feedback loops, using root-locus techniques, stability cri-
teria, and criteria for satisfactory control.

Unit 2 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 3C
Prerequisites: 48.031, 48.032.
Unit 1 Design Workshop S1 L1 T2
Consideration of the ways and means of attempting a design
48.044 Chemical Engineering Laboratory 2  S1 T3
Prerequisites: 48.031, 48.032, 48.033, 48.036, 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.

48.046 Chemical Engineering Project  F T6
Prerequisites: Meritorious performance in Year 3 Chemical Engineering subjects.

48.047 Chemical Engineering 3D  S1 T3
Prerequisites: 48.031, 48.032, 48.033, 48.163, 48.042
Unit 1 Management  S2 L2
A workshop comprising exercises and case studies to introduce the human and organizational aspects of managing process or engineering enterprises. Includes discussion of typical organization structures and reasons for choosing them; problems of managing people in organizations, industrial relations questions.

Unit 2 Process Engineering 2  S1L1 S2T1

Unit 3 Process Dynamics and Control 2  S2 L1T1
Frequency response analysis and synthesis techniques. Control of dead time and distributed systems. Cascade feedforward and other multiloop systems. Introduction to analysis of multivariable systems. Identification and estimation techniques. Digital implementation of control algorithms.

48.090 Industrial Experience
Students are expected to accumulate, by the end of the four year course, twelve weeks of industrial experience gained during recesses.

48.113 Chemistry of Industrial Processes  F L1T2
Prerequisite: 2.102A. Co- or prerequisites: 2.102B, 2.102C.
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, aluminum 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.

48.115 Industrial Electrochemistry  S1 or S2 L2
Prerequisites: 48.113, 48.138.
Fundamentals of electrodes, the Butler-Volmer equation, current/potential laws in relationship to reaction mechanism. Electrolysis, 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.

48.116 Water Chemistry  S1 or S2 L2

48.124 Applied Kinetics  S1 L1T1
Prerequisites: 48.138, 48.136.
Adsorption theory, kinetics of catalytic and non-catalytic fluid-solid reactions, rates of surface reaction, kinetics of heterogeneous reactions affected by diffusion, catalyst characterization.

48.125 Industrial Chemistry 1A  S1 L1½T2½ S2 L1½T³½
Comprises 48.021 Units 1 and 2.

48.126 Industrial Chemistry 1B  S1 L1 and S2 L3
Comprises 48.022 Units 1 and 2.

48.134 Applied Thermodynamics  S1 L1T1
Prerequisites: 48.135, 48.171.
Phase equilibria in binary and ternary systems. A study of chemical equilibria in multicomponents, polyphase systems including appropriate computational methods.

48.135 Thermodynamics S1 L2T1

Co- or prerequisite: 2.102A.

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 1 S1 L1 S2 L2

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, mixes 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 2A S1 L2

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 2B S2 L2T1

Consists of Computation 2, normally given to chemical engineering students in 48.032, and a course on electro 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.

48.163 Instrumentation and Process Control 1 S2 L2T1

Prerequisites: 10.031, 48.122 or 2.102D. 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.

48.165 Laboratory Automation Science S1 L1T1

Prerequisite: 48.163.

The application of computers, eg microcomputers, to real-time data acquisition and process control in chemical laboratories and selected processes of interest to industrial chemists. Introduction to real-time digital operations and data manipulation. Organization of a process control computer. Hardware considerations. The process/computer interface. Sequential and programmable logic control of batch processes. Data acquisition and process monitoring techniques. Digital process control PID controller tuning. Graphics in process monitoring and control. Direct Digital Control.

48.166 Microprocessors in Analytical Instrumentation S1 or S2 L1T1

Prerequisite: 1.9222. Co-requisite 48.165.

Computer interfacing to analytical instrumentation at a more fundamental level than that encountered in 48.165, Laboratory Automation Science, and is suited to students who envisage working in a research and development environment, where greater flexibility and a more innovative approach are needed in data acquisition and control operations. Transducers, instrumentation amplifiers. Signal filtering, conditioning, and processing. Data conversion systems. Principles of instrument interfacing. Interface hardware. Typical analytical instrumentation interfaces.

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 2 S1 L2T2

48.174 Seminar F T2
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.

48.194 Project (Industrial Chemistry) S1 T8 S2 T16
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
These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Combined Sciences Handbook.

48.101 Computation and Modelling in Applied Chemistry
Not offered in 1988.

For further information regarding the following subject see the Faculty of Engineering Handbook.

48.412 Polymer Materials S1 2 S2 4
The structure and synthesis of commercially important polymers including thermoplastics, fibres, rubbers and composites. The effect of chemical and molecular structure upon properties. Degradation. Mechanical properties including time dependent behaviour. Fabrication processes. Polymer selection for various applications.

42.105 Biological Process Engineering F L2T4
Prerequisite: 44.101.

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 1, 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. Other energy sources including solar energy and nuclear energy are discussed. The national and global situation is reviewed.

48.303 Fuel Science for Industrial Chemists S1 or S2 L2
Units 1 and 4 of 48.321 Fuel Engineering 2.

48.311 Fuel Engineering 1 F L2
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.
Applied Science

Unit 3 Fuel Processing


Unit 4 Fuel Plant Technology

Design principles of boilers. Boiler water conditioning. Introduction to furnaces, ovens, kilns, etc.

48.321 Fuel Engineering 2

Unit 1 Combustion — Fundamentals and Science


Unit 2 Principles of Gasification

Thermodynamics of basic reactions and calculation of equilibrium compositions. The production of fuel and synthesis gases, controlled furnaces atmospheres; gas purification.

Unit 3 Radiation Head Transfer and Engineering Applications


Unit 4 Measurements in Flames and Furnaces


Unit 5 Laboratory

Analysis and characterization of solid, liquid and gaseous fuels.

48.331 Fuel Engineering 3

Unit 1 Combustion Engineering


Unit 2 Furnace Design

Furnace design for continuous or intermittent operation.

Unit 3 Fuel Plant Design


Unit 4 Fuel Conservation and Efficiency

A case history and investigative approach to energy saving in industrial, commercial and domestic applications.

Unit 5 Liquid Fuels


Unit 6 Coal and its Evaluation

Constitution, classification and evaluation of coals. Carbonization: blending, additives, plastic behaviour.

Unit 7 Laboratory

48.340 Fuel Engineering Project

Projects selected involving the design of fuel plant or experimental aspects of fuel science and/or processing and utilization.

Department of Polymer Science

48.403 Polymer Science

Prerequisites: 2.102A, 2.102B, 10.031, 10.301. Co- or prerequisites: 48.001, 48.113.


48.404 Advanced Polymer Science

Prerequisite: 48.403.

Selected topics from basic texts and the original literature covering polymer analysis: physics of glassy polymers, viscoelasticity, polymer rheology, polymer morphology fracture and environmental stress cracking, rubber elasticity, anionic cationic and Ziegler-Natta catalysis in polymer chemistry, emulsion polymerization, silicon polymers and polymers for high temperature service.
20.303G Well Drilling & Completions

20.305G Drilling & Production Laboratory

20.306G Petroleum Production Economics

20.309G Reservoir Engineering

20.403G Production Engineering

20.406G Reservoir Simulation Fundamentals

20.409G Petroleum Engineering Project
An applied research project on a field problem of relevance to the research effort of the Centre and of practical interest to the oil industry. To be submitted as an individual thesis. Topic must be approved by the Director of the Centre.

20.410G Well Pressure Testing
Theory of transient well testing. Practical aspects of design and performance of field test instrumentation. Pressure build-up tests.

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.

48.084G System Simulation and Control

This is a participatory course in which case studies, discussion 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 systems 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


48.089G Graduate Colloquia

Colloquia on research developments in the School of Chemical Engineering and Industrial Chemistry. 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


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.

48.093G Safety in Laboratories S1


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.

48.150G Instrumental Analysis for Industry F L1T2

Role of analysis in process optimization. Accuracies of analytical methods compared to needs for equality control. Frequency of analysis in relationship to control and analytical costs. Importance of speed of analysis for information feedback. Case studies for selected processes in relation to selecting the analytical method.

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
Undergraduate Study: Subject Descriptions

accuracies and application. Steady state and rapid scan voltammetry, stripping voltammetry, chronopotentiometry, classical coulometry and potentiometry. Instrument design and modification for specific needs.

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. Case histories.

48.388X Unit Operations in Wastewater, Sludge and Solid Waste Management

48.387G Fuel Technology Practice
Compulsory in MAAppSc (Fuel) (4 SU). Content bias towards choice of G subjects.

48.391G Atmospheric Pollution and Control (Theory) S1 or S2 L3
Causes, properties, dispersion, measurement and monitoring control and legislation of air pollution in ambient and industrial environments.
48.391X Atmospheric Pollution and Control (Theory) S1 or S2 L3
Causes, properties, dispersion, measurement and monitoring, control and legislation of air pollution in ambient and industrial environments.

48.392G Practical Aspects of Air Pollution Measurement and Control S1 or S2 T3
Prerequisite: 48.391G or equivalent.
Laboratory and tutorial programs in the measurement and analysis of ambient and industrial air pollutants. Computation tutorials in advanced dispersion models, aerosol dynamics and control equipment design parameters.

48.900G Major Project
A substantial project on some aspects 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.

48.410G Analytical Characterization of Polymers S1 or S2 L3T3
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

48.440G Polymer Physics S1 or S2 L4T2

48.900G Major Project
A substantial project on some aspects 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 Fibre Science and Technology
School of Fibre Science and Technology

Head of School
Associate Professor R. E. Griffith

The School of Fibre Science and Technology was established in 1986 to bring together the University's activities in Wool and Pastoral Sciences and Textile Technology. The objectives of the School include the provision of comprehensive education of undergraduate and postgraduate students in the science and technology of: (i) production and marketing of wool fibre and other ruminant animal products, with special emphasis on wool fibre; (ii) production and marketing of other textile fibres; (iii) processing of textile fibres and their manufacture into consumer and industrial products; and (iv) performance and properties of textile and related fibre products.

These objectives are achieved by providing an undergraduate course in Wool and Pastoral Sciences which emphasises the plant and animal sciences relevant to production in the sheep industry, as well as preparation of wool for market, specification of wool, marketing of wool and the relationship between wool production and wool processing; and by providing undergraduate courses in Textile Technology (in which there are streams in Textile Chemistry, Textile Engineering and Textile Physics) and Textile Management. While Wool and Pastoral Sciences mainly deals with wool and similar fibres such as cashmere and mohair produced by goats, as well as more general features of animal production, Textile Technology covers all fibres and all aspects of their utilization in consumer and industrial products.

Rapidly advancing developments in the primary and secondary fibre industries make close collaboration between workers from the production and processing sides essential. Many of these developments have been stimulated by objective measurement of fibre properties—a special area of expertise of the Department of Wool and Animal Science—and the objective specification of textile products in which the Department of Textile Technology is a world leader. In the sheep industry these developments have major implications for systems of wool production particularly in areas such as nutrition, genetics, breeding and management. The establishment of the School provides a unique opportunity for integration of educational and research efforts right through from production of fibres to finished textile products. The School provides a stimulating environment for students who wish to make careers in the rural and manufacturing industries, both of which are critically important in the economy of Australia.

Department of Textile Technology

Head of Department
Associate Professor R. Griffith

Textile Technology is concerned with the conversion of both natural and man-made fibres into an extremely wide variety of finished products. These range from fabrics for apparel, soft furnishings, floor coverings and industrial use to such specialized textiles as tyre cord, ropes, protective clothing, sailcloth, parachute fabrics, medical dressings, composite materials, and many others.

In Australia, the textile industry has developed mainly in the past sixty years and today it is one of our largest manufacturing groups. As in overseas countries, the impact of science is bringing rapid changes to the industry, and a consequence of this has been a strong demand for personnel skilled in Textile Technology and Management.

Department of Wool and Animal Science

Head of Department
Associate Professor J.P. Kennedy

Agricultural products, particularly wool, still contribute a significant share of Australia's export income. The pastoral industry has
also played a major role in the development of the continent and the largest single form of land-use still is grazing by sheep and cattle.

Farming has advanced technologically in recent years, however innovations are continually being sought to increase productivity, raise quality and improve marketing of rural products within the framework of local and international economics. There is a continual need for the feeding and clothing of humans on a planet with finite mineral and fuel resources. This challenge must be balanced with the need for conservation and careful manipulation of a pool of renewable living resources. Wool and pastoral scientists are required to research, communicate and administer the changes which are occurring.

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**Staff**

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**School of Fibre Science and Technology**

Associate Professor, Head of School and Head of Department of Textile Technology
Ross Ernest Griffith, BSc N.S.W., PhD Leeds, CText, ATI

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**Department of Textile Technology**

Associate Professor and Head of Department
Ross Ernest Griffith, BSc N.S.W., PhD Leeds, CText, ATI

Professor of Textile Physics
Ronald Postle, BSc N.S.W. PhD Leeds, CText, FTI, FAIP

Senior Lecturers
John Ilmar Curiskis, BSc PhD N.S.W., GAIP
Nigel Anthony Gull Johnson, BSc N.S.W., PhD Leeds, CText, ATI
Michael Thomas Pailthorpe, BSc PhD N.S.W., CText, FTI

Lecturer
Shontha David MSc Waik, N.Z. PhD Br.Col.

Professional Officers
Jindrich Vavrinec Brancik, MSc Brno, PhD N.S.W., MACS, FRSC
Rup Chand Dhingra, BSc Punj, MTech I.I.T.Delhi, PhD N.S.W., FTI
Michael David Young, BSc PhD N.S.W., CText, ATI

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**Department of Wool and Animal Science**

Associate Professor and Head of Department of Wool and Animal Science
John Patrick Kennedy, MSc N.S.W., Bsc Oxf., FAIAS

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Associate Professors
John William James, BA Wld., DSc N.S.W.
Walter Raghnaill McManus, BScAgr Syd., PhD N.S.W.
Euan Maurice Roberts, MAgSc N.Z., PhD N.S.W.

Senior Lecturers
Stephen James Filan, BAgEc N.E., MSc N.S.W., MAIAS
Douglas McPherson Murray, BAgSc PhD Melb., MRurSc N.E.
Dennis Charles Teasdale, BSc MBA N.S.W. CText, ATI

Lecturer
Gordon Whistfield King, BSc PhD N.S.W., DipFinMgt N.E., MAIAS, AASA

Senior Instructor
Ronald Edward Sallaway

Professional Officers
David John Petrie, BSc N.S.W.
Ian Rowden McRae, BSc (Forestry) A.N.U., MSc N.S.W.
Course Outlines

Undergraduate Study

Department of Textile Technology

The Department of Textile Technology offers courses in Textile Technology and Textile Management. Both courses extend over four years full-time study and lead to the award of the degree of Bachelor of Science. For the award of Honours, students need to have distinguished themselves in formal studies, laboratory exercises, and in their final year project. Graduates of both courses qualify for membership of the Textile Institute.

Students in both courses must complete a minimum of 40 working days approved industrial training, of which at least 30 working days training must be taken at the end of the third year of study. It is important to stress that the specialised nature of the training provided within the Department of Textile Technology does not mean a restricted range of job opportunities after graduation. Career possibilities extend through the textile industry, allied industries (such as the production of textile chemicals and surgical dressings), private consultants, government departments and authorities, teaching at secondary and tertiary levels, and pure or applied research in various organisations.

Graduates may be employed in quality control, technical management, research and development, international trade, production or general management. Within the textile industry graduates may, for example, enter any of the following areas: the manufacture of natural and/or man-made fibres, yarns, fabrics, etc.; dyeing, printing and finishing of textiles; quality assurance; marketing and retailing, etc.

General Education Electives

For details of changes in the General Education requirements refer to the table earlier in this section.

3170

Textile Technology — Full-time Course

Bachelor of Science

BSc

Textile Chemistry, Textile Physics, Textile Engineering Options

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. It follows, therefore, that the disciplines involved in the study of textile technology, in addition to the technological aspects, includes a study in depth of one of the following: chemistry, engineering or physics.

Graduates will qualify for membership of one of the following professional bodies, depending upon which option of the course is taken: the Royal Australian Chemical Institute; the Institute of Engineers, Australia; or the Australian Institute of Physics.

All students take a common first year, and they need not choose the option they desire to follow until the end of that year.

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<th>Year 1 (All courses)</th>
<th>Hours per week</th>
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<td>S1</td>
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<tr>
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<td>5.0011 Engineering Mechanics 1, and</td>
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<td>5.0012 Introductory Engineering Design and Material Science, or</td>
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<td>9.510 Natural Fibre Production</td>
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<td>10.001 Mathematics 1</td>
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<td>13.100 Fibre Science</td>
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<td>48.122 Instrumental Analysis</td>
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<td>2.102C Inorganic Chemistry and Structure</td>
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<tr>
<td>2.113B Synthetic Organic Chemistry</td>
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<td>2.133B Applied Organic Chemistry</td>
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### Textile Physics

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<td>1.002 Mechanics, Waves and Optics</td>
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<td>1.012 Electromagnetism and Thermal Physics</td>
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Plus one of the following subjects

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<tr>
<td>1.032 Laboratory*</td>
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*Students should note that particular electives in Year 3 require one or other of these subjects as pre-requisites.

### Textile Engineering

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<td>5.620 Fluid Mechanics 1</td>
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</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.301 Textile Science 2</td>
<td>2 2</td>
</tr>
<tr>
<td>13.302A Textile Testing 2A</td>
<td>3 0</td>
</tr>
<tr>
<td>13.302B Textile Testing 2B</td>
<td>0 4</td>
</tr>
<tr>
<td>13.303A Yarn Technology 2A</td>
<td>3 1/2</td>
</tr>
<tr>
<td>13.303B Yarn Technology 2B</td>
<td>0 2 1/2</td>
</tr>
<tr>
<td>13.304A Fabric Technology 2A</td>
<td>3 1/2</td>
</tr>
<tr>
<td>13.304B Fabric Technology 2B</td>
<td>0 2 1/2</td>
</tr>
<tr>
<td>13.306A Colour Science</td>
<td>3 0</td>
</tr>
<tr>
<td>13.306B Colouration Technology</td>
<td>0 4</td>
</tr>
<tr>
<td>13.308 Textile Engineering 2</td>
<td>0 4</td>
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<td>General Studies Elective</td>
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</table>

Plus one of the following subjects

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.022 Modern Physics*</td>
<td>2 2</td>
</tr>
<tr>
<td>1.032 Laboratory*</td>
<td>3 3</td>
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*The subject to be taken will be that one not chosen in Year 2.

### Plus Physics electives (minimum 6 session hours)

<table>
<thead>
<tr>
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<th>Hours per week</th>
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<tbody>
<tr>
<td>1.023 Statistical Mechanics and Solid State Physics</td>
<td>4 0</td>
</tr>
<tr>
<td>1.0343 Advanced Optics</td>
<td>0 2</td>
</tr>
<tr>
<td>1.0533 Experimental Physics B1</td>
<td>4 0</td>
</tr>
<tr>
<td>1.0543 Experimental Physics B2</td>
<td>0 4</td>
</tr>
<tr>
<td>1.1433 Biophysics</td>
<td>3 0</td>
</tr>
<tr>
<td>1.1533 Biophysics Techniques</td>
<td>0 3</td>
</tr>
<tr>
<td>1.3033 Mechanical Properties of Materials</td>
<td>2 0</td>
</tr>
<tr>
<td>1.713 Advanced Laser and Optical Applications</td>
<td>2 2</td>
</tr>
<tr>
<td>1.9422 Introduction to Physics of Measurement</td>
<td>3 0</td>
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</table>

### Year 4 (All Options)

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.400 Textile Industry Studies</td>
<td>2 0</td>
</tr>
<tr>
<td>13.401A Textile Science 3A</td>
<td>2 0</td>
</tr>
<tr>
<td>13.401B Textile Science 3B</td>
<td>0 2</td>
</tr>
<tr>
<td>13.404 Fabric Technology 3</td>
<td>2 0</td>
</tr>
<tr>
<td>13.405A Finishing Technology A</td>
<td>4 0</td>
</tr>
<tr>
<td>13.405B Finishing Technology B</td>
<td>0 4</td>
</tr>
<tr>
<td>13.460 Processing Laboratory</td>
<td>1 1/2</td>
</tr>
<tr>
<td>13.470 Seminar</td>
<td>1 1/2</td>
</tr>
<tr>
<td>13.480 Project</td>
<td>7 7</td>
</tr>
<tr>
<td>18.1211 Production Management A</td>
<td>3 0</td>
</tr>
<tr>
<td>18.1212 Production Management B</td>
<td>0 3</td>
</tr>
<tr>
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<td>2 2</td>
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</table>

Plus one advanced Textile Option

<table>
<thead>
<tr>
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<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.451 Advanced Textile Physics</td>
<td>0 2</td>
</tr>
<tr>
<td>13.456 Advanced Textile Chemistry</td>
<td>0 2</td>
</tr>
<tr>
<td>13.458 Advanced Textile Engineering</td>
<td>0 2</td>
</tr>
</tbody>
</table>
The production and marketing of textile products involves a number of manufacturing processes, and requires an understanding of basic management principles. The Textile Management course provides a comprehensive knowledge of all the textile sciences and technologies. In addition the course includes studies in economics, accounting, marketing, management, and other areas of commerce.

The course is designed to meet the need for executives in the textile and allied industries. A wide choice of electives is available in the third year of the course. This allows students to either gain a broad knowledge of the various areas of commerce, or to specialise in one of the following areas: Applied Economics; Accounting and Financial Management; or, Managerial Marketing.

### Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.001 Physics 1, or</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>10.011 Introductory Physics</td>
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<td>0</td>
</tr>
<tr>
<td>10.021 Introductory Chemistry, or</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>10.021B General Mathematics 1 and</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>10.021C General Mathematics 1C</td>
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<td>6</td>
</tr>
<tr>
<td>14.501 Fibre Science</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>14.502 Microeconomics 1</td>
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<tr>
<td>14.502E Macroeconomics 1</td>
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<td>3(\frac{1}{2})</td>
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| Total Horas per week                           | 21\(\frac{1}{2}\) | 21\(\frac{1}{2}\) |

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.201 Statistics A</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13.201A Computing Applications</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>13.201B Textile Science 1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>13.202 Textile Testing 1</td>
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<td>4</td>
</tr>
<tr>
<td>13.203A Yarn Technology 1A</td>
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<td>0</td>
</tr>
<tr>
<td>13.203B Yarn Technology 1B</td>
<td>0</td>
<td>2(\frac{1}{2})</td>
</tr>
<tr>
<td>13.204A Fabric Technology 1A</td>
<td>2(\frac{1}{2})</td>
<td>0</td>
</tr>
<tr>
<td>13.204B Fabric Technology 1B</td>
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<td>2(\frac{1}{2})</td>
</tr>
<tr>
<td>13.208 Textile Engineering 1</td>
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<tr>
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<td>14.511 Accounting and Financial Management 1B</td>
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<td>28.012 Marketing Systems</td>
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<tr>
<td>28.052 Marketing Research</td>
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</tr>
<tr>
<td>General Studies Elective</td>
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<td>2</td>
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</tbody>
</table>

| Total Horas per week                           | 23\(\frac{1}{2}\) | 23\(\frac{1}{2}\) |

### Year 3

<table>
<thead>
<tr>
<th>Course</th>
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<th>S2</th>
</tr>
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<tbody>
<tr>
<td>13.301 Textile Science 2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>13.302A Textile Testing 2A</td>
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<td>0</td>
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<tr>
<td>13.302B Textile Testing 2B</td>
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<td>4</td>
</tr>
<tr>
<td>13.303A Yarn Technology 2A</td>
<td>3(\frac{1}{2})</td>
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</tr>
<tr>
<td>13.303B Yarn Technology 2B</td>
<td>0</td>
<td>2(\frac{1}{2})</td>
</tr>
<tr>
<td>13.304A Fabric Technology 2A</td>
<td>3(\frac{1}{2})</td>
<td>0</td>
</tr>
<tr>
<td>13.304B Fabric Technology 2B</td>
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<td>2(\frac{1}{2})</td>
</tr>
<tr>
<td>13.305A Colour Science</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>13.305B Colouration Technology</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>13.308 Textile Engineering 2</td>
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<td>4</td>
</tr>
<tr>
<td>General Studies Electives</td>
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<td>2</td>
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</table>

| Total Horas per week                           | 19 | 19 |

### Year 4

<table>
<thead>
<tr>
<th>Course</th>
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<th>S2</th>
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<tbody>
<tr>
<td>13.400 Textile Industry Studies</td>
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</tr>
<tr>
<td>13.401A Textile Science 3A</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>13.401B Textile Science 3B</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>13.404 Fabric Technology 3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>13.405A Finishing Technology A</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>13.405B Finishing Technology B</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>13.457 Advanced Textile Management</td>
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<td>2</td>
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<tr>
<td>13.460 Processing Laboratory</td>
<td>1(\frac{1}{2})</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>13.470 Seminar</td>
<td>1(\frac{1}{2})</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>13.480 Project</td>
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</tr>
<tr>
<td>18.1211 Production Management A</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>18.1212 Production Management B</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>General Studies Electives</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

| Total Horas per week                           | 25 | 23 |

**Note:** Students who enrolled in Year 1 1987 will substitute 15.001 and 15.011 for 28.012 and 28.052 in Year 2. In Year 3 those students must take 28.012 and 28.052 in lieu of Commerce electives.

### Department of Wool and Animal Science

The Department offers a full-time course of four years duration leading to the award of a Bachelor of Science degree at either Honours or Pass level. The course is the only one in Australia which special emphasis is given to wool science. In addition, studies concentrate on the most important animal industries (sheep and cattle).

Students receive a thorough grounding in the appropriate basic scientific disciplines as well as application of principles which are relevant to all aspects of pastoral production, including production and utilization of pastures; reproduction, nutrition, health, genetic improvement, ecology and...
management of grazing animals and the production, preparation for sale and specification of wool and meat. The course also includes study of the design and interpretation of experimental investigations, economics and business management as well as elective options on crop production, rangeland management and rural communications. Relevant subjects offered by other schools may also be included. An important component is the final year project whereby students engage in an area of personal research on a theoretical or experimental topic on which they are required to submit a thesis.

The course provides students with a broad overview of the pastoral industries. It aims to produce generalists rather than specialists and, although there is some scope for studying topics of special interest, the course is designed so that certain core subjects must be undertaken. Because of the broad education received, graduates are equipped for a wide variety of careers in and associated with agricultural production including research, advisory work, education, marketing, management and administration. Graduates are eligible for corporate membership of the Australian Institute of Agriculture Science.

The Department also 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 Department.

General Education Electives

For details of changes in the General Education requirements refer to the table earlier in this section.

3220
Wool and Pastoral Sciences — Full-time Course

Bachelor of Science

BSc

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
<tr>
<td>2.121 Chemistry 1A</td>
<td>6</td>
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<tr>
<td>2.131 Chemistry 1B</td>
<td>6</td>
</tr>
<tr>
<td>9.510 Natural Fibre Production</td>
<td>6</td>
</tr>
<tr>
<td>10.001 Mathematics 1 or</td>
<td>6</td>
</tr>
<tr>
<td>10.011 Higher Mathematics 1 or</td>
<td>6</td>
</tr>
<tr>
<td>10.021B General Mathematics 1B and</td>
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<td>17.041 Biology B</td>
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<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
<tr>
<td>2.003J Agricultural and Biological Chemistry</td>
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<tr>
<td>9.111 Livestock Production 1</td>
<td>2</td>
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<tr>
<td>9.201 Agronomy</td>
<td>3</td>
</tr>
<tr>
<td>9.301 Agricultural Economics and Management</td>
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<tr>
<td>9.501 Wool Science 1</td>
<td>3</td>
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<tr>
<td>9.601 Animal Physiology 1</td>
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<tr>
<td>10.301 Statistics SA</td>
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<tr>
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<tr>
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<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
<tr>
<td>9.131 Animal Health and Welfare</td>
<td>3</td>
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<tr>
<td>9.202 Pastoral Agronomy</td>
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<td>9.421 Animal Nutrition</td>
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<td>9.502 Wool Science 2</td>
<td>3</td>
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<tr>
<td>9.801 Genetics</td>
<td>3</td>
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<td>4</td>
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<td>41.101 Biochemistry</td>
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Plus one of the three available options

<table>
<thead>
<tr>
<th></th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>9.112 Livestock Production 2</td>
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</tr>
<tr>
<td>9.203 Crop Agronomy*</td>
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</tr>
<tr>
<td>9.204 Range Management*</td>
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<tr>
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*Available in alternate years

<table>
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<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
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<tr>
<td>9.001 Project</td>
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<tr>
<td>9.002 Seminar</td>
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<tr>
<td></td>
<td>25</td>
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</table>

Plus at least 14 hours each session of optional subjects. Not more than one subject in each session may be chosen from Group B.
Optional subjects

Group A

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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<th>S2</th>
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<tbody>
<tr>
<td>9.112</td>
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<tr>
<td>9.113</td>
<td>Livestock Production 3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9.132</td>
<td>Animal Health 2</td>
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<tr>
<td>9.203</td>
<td>Crop Agronomy*</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.204</td>
<td>Range Management*</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.503</td>
<td>Wool Science 3</td>
<td>4</td>
<td>4</td>
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<tr>
<td>9.504</td>
<td>Wool Marketing</td>
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<td>3</td>
</tr>
<tr>
<td>9.602</td>
<td>Genetics 2</td>
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<td>4</td>
</tr>
<tr>
<td>9.612</td>
<td>Biostatistics 2</td>
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<tr>
<td>9.901</td>
<td>Rural Extension</td>
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*Available in alternate years

Group B

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>S1</th>
<th>S2</th>
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</thead>
<tbody>
<tr>
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<td>Introduction to Remote Sensing</td>
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<tr>
<td>27.176</td>
<td>Remote Sensing Applications</td>
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<td>4</td>
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<tr>
<td>28.012</td>
<td>Marketing Systems</td>
<td>4</td>
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<td>28.052</td>
<td>Marketing Research</td>
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<td>43.121</td>
<td>Environmental Physiology</td>
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<td>43.142</td>
<td>Environmental Botany</td>
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<td>44.101</td>
<td>Introductory Microbiology</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Or such other subjects as may be approved by the Head of Department.

Graduate Study

Department of Textile Technology

The Department conducts a course which leads to the award of a Graduate Diploma in Textile Technology.

In addition, the Department 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 or Doctor of Philosophy.

The Head of the Department is pleased to give information about research scholarships, fellowships and Department research activities. Graduates are advised to consult the Head of Department before making a formal application for registration.

5090 Textile Technology Graduate Diploma Course

Graduate Diploma GradDip

The course leading to the award of Graduate Diploma in Textile Technology is designed to prepare graduates for careers in the textile and allied industries. It also provides formal studies for graduates who are already employed in the textile industry. The normal requirement for admission to the course is a Bachelor degree or equivalent tertiary qualification.

The following program, which comprises both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course.

<table>
<thead>
<tr>
<th>Core Subjects</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2 0</td>
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<tr>
<td>13.721G Fibre Science B</td>
<td>0 2</td>
</tr>
<tr>
<td>13.712G Textile Testing A</td>
<td>4 0</td>
</tr>
<tr>
<td>13.722G Textile Testing B</td>
<td>0 4</td>
</tr>
<tr>
<td>13.717G Textile Technology</td>
<td>1½ 1½</td>
</tr>
<tr>
<td>13.727G Textile Technology Dissertation</td>
<td>1½ 1½</td>
</tr>
<tr>
<td></td>
<td><strong>9 9</strong></td>
</tr>
</tbody>
</table>

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 Fibre Science and Technology and Heads of the other School's concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

<table>
<thead>
<tr>
<th>Optional Subjects</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.713G Yarn Technology A</td>
<td>4½ 0</td>
</tr>
<tr>
<td>13.723G Yarn Technology B</td>
<td>0 4½</td>
</tr>
<tr>
<td>13.714G Fabric Technology A</td>
<td>4½ 0</td>
</tr>
<tr>
<td>13.724G Fabric Technology B</td>
<td>0 4½</td>
</tr>
</tbody>
</table>

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.

Department of Wool and Animal Science

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, Applied Science, 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.

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:

9.105G Livestock Production
9.205G Range Management
9.504G Wool Science
9.803G Animal Breeding
9.813G Quantitative Methods

Hours per week
6
4
6
4
4
Subject Descriptions

Undergraduate Study Fibre Science

Department of Wool and Animal Science

9.001 Project
Prerequisite: 9.131.
F L T
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
Prerequisite: 9.131.
F T
Seminars deal with research and/or development work being undertaken or recently completed by students and staff of the Department of Wool and Animal Science, other University schools and research organizations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries.

9.111 Livestock Production 1
Prerequisite: 9.111.
F L
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 2
Prerequisite: 9.111.
S2 L T
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 3
Prerequisite: 9.111.
F L T

9.131 Animal Health and Welfare 1
Prerequisite: 9.111.
S1 L T

9.132 Animal Health 2
Prerequisite: 9.131.
S1 L T

9.201 Agronomy
Prerequisite: 9.201.
S L T

9.202 Pastoral Agronomy
Prerequisite: 9.201.
F L

9.203 Crop Agronomy
Prerequisite: 9.201.
S L T

9.204 Range Management
S L T
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 1  
F L2T1
The subjects covers two broad strands: basic economic principles, and applied methods for farm management planning. The material on economic principles centres on 1. the theory of production economics, which provides the background for many of the tools of applied farm management; and 2. price theory with emphasis on agricultural markets. The management planning strand emphasizes 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.

9.421 Animal Nutrition  
S2 L3T1
Composition and classification of foodstuffs and pastures. Physiology of ruminant digestion. Digestion absorption and metabolism of carbohydrates, proteins, fats, mineral 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 1  
F L2T1
Fibre structure; physical and chemical properties, variability of fibre properties. Physical fleece characteristics; fleece defects. Early stage processing and yarn manufacture.

9.502 Wool Science 2  
F L2T1

9.503 Wool Science 3  
F L2T2

9.504 Wool Marketing  
S2 L2T1
Wool marketing systems; comparison with other countries, modelling. Wool commerce; financial factors. Information systems. Future directions.

9.510 Natural Fibre Production  
S1 L3T3
Wool and other animal fibres: fibre and skin biology; mechanisms of, and factors affecting, fibre growth, fibre morphology; introduction to fibre production, harvesting, preparation for sale and marketing. Cotton: cotton growth; fibre morphology; factors affecting fibre growth; fibre production harvesting, handling and marketing. Production statistics and economics of natural fibre production in Australia contrasted to world fibre production.

9.601 Animal Physiology 1  
S2 L3T3
Prerequisite: 17.041.
Physiology 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.

9.801 Genetics 1  
F L2T1

9.802 Genetics 2  
F L2T2
Prerequisite: 9.801.

9.811 Biostatistics 1  
S1 L2T2
Design and analysis of comparative experiments, for continuous and discrete random variables. Analysis of variance for fixed, mixed and random models. Linear regression and correlation. Multiple comparison methods.

9.812 Biostatistics 2  
S2 L2T2
Least squares methods, applied to multiple regression and experimental design models. Factorial experiments. Analysis of covariance. Elements of multivariate analysis.

9.901 Rural Extension  
S1 L2T2
Development of communication skills through experiential or active learning situation. Educational, psychological and sociological factors relating to the diffusion of innovations. Program planning and evaluation.
Students should note that enrolment in all later year subjects taught by the Department is subject to satisfactory course progression and approval of the Head of School.

**13.100 Fibre Science**


**13.200 Computing Applications**

Introduction to computer architectures: microcomputers and mainframes; peripheral devices; communications networks. Hardware and software concepts; firmware and operating systems. Introduction to computer programming: program control, structure, logic and debugging; levels of programming languages; simple algorithms; data organization. Computer applications in fibre science and technology: computer-aided design and manufacture (CAD/CAM); process monitoring and control, computer-integrated manufacture (CIM); data acquisition; data analysis, statistical packages; modelling and optimisation techniques; databases, spreadsheets, text/word processing; recent developments and future trends.

**13.201 Textile Science 1**


**13.202 Textile Testing 1**


**13.203A Yarn Technology 1A**

Principles of staple fibre preparation: cleaning, blending, carding, drawing, combing.

**13.203B Yarn Technology 1B**

Yarn forming principles; properties of twisted fibrous assemblies; twist insertion; ring spinning; winding; rotor spinning; yarn twisting.

**13.204A Fabric Technology 1A**


**13.204B Fabric Technology 1B**

Principles of Knitting. Techniques of loop formation in weft and warp knitting; essential knitting machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Yarn preparation for knitting.

**13.208 Textile Engineering 1**

The application of engineering principles to textile machines and processes including elements of strength of materials; mechanics of solids; mechanical transmission of power; applied electricity; illumination design; process control. Analysis of engineering interactions in textile processes.

**13.301 Textile Science 2**


**13.302A Textile Testing 2A**


**13.302B Textile Testing 2B**


**13.303A Yarn Technology 2A**

Traditional staple fibrous systems: cotton, worsted, woollen. Special systems for other fibres such as mohair, silk, flax, etc. Productivity and quality in yarn production. Alternative yarn forming methods. Automation.

**13.303B Yarn Technology 2B**

Processing of continuous filament yarns; throwing, false-twist texturing, air-jet texturing, other texturing methods. Staple conversion of man-made fibres.
13.304A Fabric Technology 2A
Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxiliary mechanisms for extended design effects in Tricot and Raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitting; applications. Stitch-bonded and non woven fabric manufacture.

13.304B Fabric Technology 2B

13.306A Colour Science

13.306B Colouration Technology

13.408 Textile Engineering 2

13.400 Textile Industry Studies
Garment manufacturing technology. Econometrics of the textile and clothing industries. Models of production, import and export and consumption of textiles and clothing in Australia, and comparison with world data. Case studies in textile and clothing manufacture operations.

13.401A Textile Science 3A

13.304B Fabric Technology 2B

13.306A Colour Science

13.306B Colouration Technology

13.408 Textile Engineering 2

13.400 Textile Industry Studies
Garment manufacturing technology. Econometrics of the textile and clothing industries. Models of production, import and export and consumption of textiles and clothing in Australia, and comparison with world data. Case studies in textile and clothing manufacture operations.

13.401A Textile Science 3A
13.460 Processing Laboratory  F T1½

Students undertake a project involving the design, production and assessment of textile products. Such as: rib jacquard outer fabric, towelling, printed tea towels, woven furnishing fabric, raschel outerwear fabric, etc.

13.470 Seminar  F T1½

Students prepare and present a seminar before an audience consisting of staff of the Department, final year students, Graduate Diploma students, and any other interested undergraduate or postgraduate students, on a subject of topical and specific interest in the field of textile science, technology or commerce, and subsequently submit the seminar in writing.

13.480 Project  F T7

Students are required to carry out a research project and to submit a thesis describing their investigations. It is usual for students to be allocated projects in areas related to the particular course strand they are studying.
Graduate Study

Department of Wool and Animal Science

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

9.206G Project in Range Management  F T9
A theoretical and/or experimental investigation of some aspect of management of rangelands.

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 or 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

9.803G Animal Breeding  F L2 T2
Corequisite: 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.


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.

Department of Textile Technology

13.711G Fibre Science A  SS L2
Chemical constitution and reactivity of the natural and man-made fibres. Production of textile fibres, addition and condensation polymerisation, polymerisation kinetics, molecular weights of polymers and co-polymers, crystallinity and orientation of polymers.

13.712G Textile Testing A  SS L2 T2
The statistical basis of sampling for textile testing and quality control and assurance. Identification and selection of textile and raw materials. Measurement of fibre and yarn properties and of intermediate products which affect yarn quality (linear density, twist, irregularity).

13.713G Yarn Technology A  SS L3 T1½

13.714G Fabric Technology A  SS L3 T1½

13.715G Finishing Technology A  SS L3 T2
Objects of finishing and typical flow diagrams. The principles and technology of textile finishing processes: the removal of impurities and discolouration, the elimination or minimisation of deficiencies in the properties of textile fibres, the development of specific properties.
13.716G Colour Science

SS L2 T2

Measurement and specification of colour and aspects of colour such as colour mixing and colour vision. Computer aided colour matching.

13.717G Textile Technology

F T1½

Students gain an overview of textile technology by reviewing the technology relating to one or more textile products, through a series of tutorials and exercises.

13.721G Fibre Science B

SS L2

Molecular and morphological structure of textile fibres. Production of textile fibres, molecular weights of polymers and co-polymers, crystallinity and orientation of polymers. Relationships between molecular structure and mechanical properties of fibres.

13.722G Textile Testing B

SS L2 T2

Properties of woven, knitted and non-woven fabrics and their measurement (mechanical properties, serviceability, etc.). Measurement of consumer orientated properties (colourfastness, dimensional stability, seaming etc.). Modification and performance testing. Care-labelling and associated test requirements.

13.723G Yarn Technology B

SS L3 T1½

Structural analysis of staple fibre and continuous filament yarns. Texturing; spinning and twisting of staple yarns; worsted, woollen and cotton processing systems. Unconventional techniques of yarn forming.

13.724G Fabric Technology B

SS L3 T1½


13.725G Finishing Technology B

SS L3 T2

The production of specified dimensions in textile fabrics, mechanical processes, surface finishes, protective finishes, detergency, properties of surfactant solutions, micelle formation, emulsification. The chemistry of the application of specialised finishes such as flameproof finishes, crease-resistant finishes, etc. Recent developments in finishing technology.

13.726G Dyeing Technology

SS L2 T2

Prerequisite: 13.716G or equivalent.

Classification of dyes and their methods of application, general properties of dyes, dyeing auxiliaries and after-treatments. Mill water supplies and their treatment, dyehouse effluent treatment.

13.727G Textile Technology Dissertation

F T1½

Students review a particular aspect of textile technology, by conducting a literature survey and conferring with experts. The review is presented orally to the staff and students of the department, and submitted in written form.
School of Geography
School of Geography

Head of School
Professor B. J. Garner

Administrative Assistant
Ms. T. Bean

Geographers study the spatial relationships of the phenomena which form humans' physical and social environment, and aim to establish principles which govern those relationships. The geographer may concentrate on specific variables, as in systematic geography, or may deal with variables which affect 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 employed as professionals in these applications. 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.

General Education Electives

For details of changes in the General Education requirements refer to the table earlier in this chapter.

Staff

Professor of Geography and Head of School
Barry Jardine Garner, BA Nott., MA PhD Northwestern

Associate Professor
Ian Harry Burnley, MA Cant., PhD Well.

Senior Lecturers
Frederick Charles Bell, BSc Syd., MSc PhD N.S.W., MSocSigmaXi
John Richard Dodson, MSc Monash, PhD A.N.U.
Stephen James Filan, BAgEc N.E., MSc N.S.W.
Michael Dick Melville, BScAgr PhD Syd.
Colin Frederick Pain, MA Auck., PhD A.N.U.
Morgan Eugene Cyril Sant, BA Keele, MSc PhD Lond.
Peter Leon Simons, BA PhD Syd.
Susanne Rae Walker, MA Well., DPhil Oxf.

Lecturers
Wayne David Erskine, BA PhD N.S.W.
Geoffrey Steel Humphreys, BA PhD Macq.
Bruno Peter John Parolin, BA Monash, MS Oklahoma State.
PhD Ohio State, MIAG, MAAG, MRSA

Tutors
David John Edwards, BSc N'c/e (N.S.W.)
Scott David Mooney, BSc N.S.W.
Beverley Ann Scott, BA Macq.

Administrative Assistant
Toni Bean
Course Outlines

Undergraduate Study

The three vocationally-oriented Applied Geography programs 3010 in the Faculty of Applied Science provide an analytical approach to understanding and investigating some of society's most pressing problems, including the use and management of scarce resources, the interaction between people and environment, soil erosion and conservation, land use conflicts, and spatial inequalities in economic and social well-being. These courses provide elective specializations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography (with emphasis on spatial analysis), and in human and physical resources (with emphasis on the integration of human and physical geography).

Geography is also available as a major sequence in the Arts course 3400, where the emphasis is on the study of where and how people live, and on their activities in relation to the environment.

A major sequence in Science and Mathematics course 3970, program 2700 studies the relationships between man and his physical environment, combining geographical studies, particularly in physical geography, with those in related disciplines, notably the biological and earth sciences.

Geography may also be combined with Civil Engineering in course 3730, and with Law in course 4770.

Students may enrol through the School of Geography for higher research degrees, or for formal graduate courses such as the Master of Applied Science in Land and Geographic Information Systems 8024; Masters' and Diploma courses in Remote Sensing 8026 and 8056, or Masters' and Diploma in Arid Lands Management 8025 and 5025, and may undertake projects in the School as part of the Master of Environmental Studies degree 8045.

Applied Geography — Full-time Courses

Bachelor of Science

The School offers three 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.

There are elective specializations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography (with emphasis on urban geography), and in human and physical resources (with emphasis on the integration of physical and human geography). First year subjects involve systematic studies of the physical and economic bases of geography. There is progressive specialization in the following years, with heavy emphasis on field observation and data handling. For the award of the degree at Honours level 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 Report will be required.

All students are encouraged 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 computer and quantitative techniques. It is 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. Compulsory fieldwork incurs personal expenditure.

3010

Applied Geography — Full-time Course

Bachelor of Science

BSc

Students should consult the School before enrolling, as there may be some significant changes to these courses (especially for Year 3) before the start of the 1988 teaching year.

Applied Physical Geography, Applied Economic Geography and Human and Physical Resources

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
<tr>
<td>10.021B General Mathematics 1B and</td>
<td>6</td>
</tr>
<tr>
<td>10.021C General Mathematics 1C or</td>
<td></td>
</tr>
<tr>
<td>10.001 Mathematics 1 or</td>
<td></td>
</tr>
<tr>
<td>10.011 Higher Mathematics 1</td>
<td>6</td>
</tr>
<tr>
<td>27.010 Land Studies*</td>
<td>4</td>
</tr>
<tr>
<td>27.020 Locational Processes</td>
<td></td>
</tr>
<tr>
<td>27.030 Environmental Processes</td>
<td></td>
</tr>
<tr>
<td>27.040 Data Processing Systems</td>
<td></td>
</tr>
<tr>
<td>27.100 Field Project 1 and either</td>
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</tr>
<tr>
<td>15.001 Microeconomics 1 and</td>
<td></td>
</tr>
<tr>
<td>15.011 Macroeconomics 1 and</td>
<td>0</td>
</tr>
<tr>
<td>27.829 Australian Social Environments or</td>
<td></td>
</tr>
<tr>
<td>17.031 Biology A and</td>
<td></td>
</tr>
<tr>
<td>17.041 Biology B or</td>
<td></td>
</tr>
<tr>
<td>25.110 Earth Materials and Processes** and</td>
<td></td>
</tr>
<tr>
<td>25.120 Earth Environments and Dynamics**</td>
<td></td>
</tr>
</tbody>
</table>

| Total               | 19¼/18 | 22½/25 |

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

**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.

Note: Students will incur personal costs in connection with the field work component. Details will be provided at enrolment.
### Applied Physical Geography

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical Data Analysis</td>
<td>4 S1, 4 S2</td>
</tr>
<tr>
<td>Introduction to Remote Sensing</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Geomorphology</td>
<td>0 S1, 5 S2</td>
</tr>
<tr>
<td>Field Project 2</td>
<td>0 S1, 3 S2</td>
</tr>
<tr>
<td>Spatial Population Analysis*</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>General Education Subject</td>
<td></td>
</tr>
<tr>
<td>and either</td>
<td></td>
</tr>
<tr>
<td>Introductory Chemistry</td>
<td>6 S1, 0 S2</td>
</tr>
<tr>
<td>Chemistry 1A</td>
<td>6 S1, 0 S2</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>and either</td>
<td></td>
</tr>
<tr>
<td>Earth Materials 1 and</td>
<td>6 S1, 0 S2</td>
</tr>
<tr>
<td>Earth Materials 2**</td>
<td>0 S1, 6 S2</td>
</tr>
<tr>
<td>or any two of the following (one each session)</td>
<td></td>
</tr>
<tr>
<td>Flowering Plants</td>
<td>6 S1, 0 S2</td>
</tr>
<tr>
<td>Population and Community Ecology***</td>
<td>6 S1, 0 S2</td>
</tr>
<tr>
<td>Biology of Invertebrates</td>
<td>0 S1, 6 S2</td>
</tr>
<tr>
<td>Vertebrate Zoology</td>
<td>6 S1, 0 S2</td>
</tr>
</tbody>
</table>

19/19

*An alternative, selected from the Servicing Subjects in Geography listed in this handbook, may be substituted with the permission of the Head of School.

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

***May be taken in either Year 2 or Year 3.

Note: Students will incur personal costs in connection with the Field Project.

### Applied Economic Geography

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microeconomics 2 or</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Macroeconomics 2 or</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>Applied Microeconomics†</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Applied Macroeconomics†</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>Field Project 2</td>
<td>0 S1, 3 S2</td>
</tr>
<tr>
<td>Regional Theory</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Transport and Land Use</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Geographic Data Analysis</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Mathematical Methods for Spatial Analysis</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Project in Spatial Analysis</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>Environmental Change</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>General Studies Subject</td>
<td>0 S1, 4 S2</td>
</tr>
</tbody>
</table>

20/20

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

Note: Students will incur personal costs in connection with the Field Project.

### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Cartography</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Field Project 3</td>
<td>0 S1, 3 S2</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Project Design and Formulation</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>Geographic Data Analysis</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>Sample Surveys and Questionnaire Design</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Marketing Geography</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Regional Population Analysis</td>
<td>4 S1, 0 S2</td>
</tr>
<tr>
<td>Social Welfare and Urban Development</td>
<td>0 S1, 4 S2</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>4 S1, 0 S2</td>
</tr>
</tbody>
</table>

19/23 16/20

**One subject may be substituted for those listed with permission of Head of School.

Note: Students will incur personal costs in connection with the Field Project.
### Human and Physical Resources

#### Year 2

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.175</td>
<td>Introduction to Remote Sensing</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>27.200</td>
<td>Field Project 2</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>27.050</td>
<td>Geographical Data Analysis</td>
<td>S1: 4, S2: 4</td>
</tr>
<tr>
<td>27.183</td>
<td>Geomorphology</td>
<td>S1: 0, S2: 5</td>
</tr>
<tr>
<td>27.520</td>
<td>Regional Theory</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>and one</td>
<td>General Education Subject and one of the following</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>27.825</td>
<td>Urban Activity Systems*</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>27.223</td>
<td>Environmental change</td>
<td>S1: 0, S2: 4</td>
</tr>
</tbody>
</table>

#### Field Project 2

- Geography Data Analysis
- Geomorphology
- Regional Theory
- General Education Subject
- Urban Activity Systems*
- Environmental change

#### or one of

- Environmental Botany (43.142)
- Population and Community Ecology (45.152)

#### Hours per week

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>S2</td>
</tr>
<tr>
<td>27.175</td>
<td>4</td>
</tr>
<tr>
<td>27.200</td>
<td>0</td>
</tr>
<tr>
<td>27.050</td>
<td>4</td>
</tr>
<tr>
<td>27.183</td>
<td>0</td>
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<tr>
<td>27.520</td>
<td>4</td>
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<td>27.825</td>
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<td>27.223</td>
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</tr>
<tr>
<td>15.062</td>
<td>0</td>
</tr>
<tr>
<td>15.072</td>
<td>4</td>
</tr>
<tr>
<td>25.211</td>
<td>6</td>
</tr>
<tr>
<td>25.221</td>
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<tr>
<td>43.111</td>
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<tr>
<td>45.201</td>
<td>0</td>
</tr>
<tr>
<td>45.301</td>
<td>6</td>
</tr>
</tbody>
</table>

18/20  20/26

*An alternative, selected from the Servicing Subjects in Geography listed in this handbook, may be substituted with the permission of the Head of School.

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

***May be taken in either Year 2 or Year 3. 10.001 to 10.011 is a prerequisite.

Note: Students will incur personal costs in connection with the Field Project.

#### Year 3

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.193</td>
<td>Environmental Impact Assessment</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>27.300</td>
<td>Field Project 3</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>27.431</td>
<td>Computer Cartography</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>27.503</td>
<td>Project Design and Formulation</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>and one</td>
<td>General Education Subject</td>
<td>S1: 2, S2: 2</td>
</tr>
<tr>
<td>plus four of the following subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.133</td>
<td>Pedology</td>
<td>S1: 5, S2: 0</td>
</tr>
<tr>
<td>27.143</td>
<td>Biogeography</td>
<td>S1: 5, S2: 0</td>
</tr>
<tr>
<td>27.153</td>
<td>Climatology</td>
<td>S1: 5, S2: 0</td>
</tr>
<tr>
<td>27.176</td>
<td>Remote Sensing Applications</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>27.652</td>
<td>Geographic Information Systems</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>27.213</td>
<td>Soils and Landforms</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>27.713</td>
<td>Marketing Geography</td>
<td>S1: 0, S2: 5</td>
</tr>
<tr>
<td>27.743</td>
<td>Regional Population Analysis</td>
<td>S1: 5, S2: 0</td>
</tr>
<tr>
<td>27.753</td>
<td>Social Welfare and Urban Development</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>27.643</td>
<td>Sample Surveys and Questionnaire Design</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>and either</td>
<td>Economic Development†</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>15.053</td>
<td>Natural and Environmental Resource Economics</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>or</td>
<td>Geology for Geomorphologists and Pedologists</td>
<td>S1: 2, S2: 4</td>
</tr>
</tbody>
</table>

#### Field Project 3

- Environmental Impact Assessment
- Pedology
- Biogeography
- Climatology
- Remote Sensing Applications
- Geographic Information Systems
- Soils and Landforms
- Marketing Geography
- Regional Population Analysis
- Social Welfare and Urban Development
- Sample Surveys and Questionnaire Design
- Economic Development†
- Natural and Environmental Resource Economics
- Geology for Geomorphologists and Pedologists

#### Hours per week

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>S2</td>
</tr>
<tr>
<td>27.193</td>
<td>0</td>
</tr>
<tr>
<td>27.300</td>
<td>0</td>
</tr>
<tr>
<td>27.431</td>
<td>4</td>
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<tr>
<td>27.503</td>
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<td>27.143</td>
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<tr>
<td>25.510</td>
<td>2</td>
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</tbody>
</table>

15.053  25.510

*Up to two subjects may be substituted from those offered by the School of Geography, Department of Applied Geology or School of Biological Sciences, subject to approval by the Head of School.

Note: Students will incur personal costs in connection with project work in the final year of study.

### Geography in Other Faculties

Courses in Geography are available on a full-time basis in the Faculties of Arts and Science, and in combined courses with Engineering 3730 and with Law 4770.

### Graduate Study

#### 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 in 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:

Master of Applied Science in Arid Land Management by Course Work
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 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.

8024
Graduate Program in Land and Geographic Information Systems

Master of Applied Science MAppSc

The Masters degree program in Land and Geographic Information Systems is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications: Four-year Honours degree of appropriate standard in Geography, Geology, Surveying, or a relevant environmental science.

Course requirements. Candidates are required to complete a course totalling at least 36 credits (1 credit equals 1 hour per week for one session), made up of compulsory subjects, elective subjects and a project or research project. 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.644G</td>
<td>Computer Mapping and Data Display</td>
<td>3</td>
</tr>
<tr>
<td>29.217O</td>
<td>Computer Graphics</td>
<td>2*</td>
</tr>
<tr>
<td>6.580G</td>
<td>Image Analysis in Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>55.817G</td>
<td>Information Storage and Retrieval Systems</td>
<td>6</td>
</tr>
<tr>
<td>55.815G</td>
<td>Economics of Information Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.950G</td>
<td>Project</td>
<td>9</td>
</tr>
<tr>
<td>27.951G</td>
<td>Research Project</td>
<td>18</td>
</tr>
</tbody>
</table>

*Additional tutorials and assignments will increase subject to 3 credits

Compulsory subjects not offered in a particular year, and other elective subjects than those listed, may be substituted by equivalent subjects approved by the Head of School.

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.915G</td>
<td>Project in Hydrogeology or</td>
</tr>
<tr>
<td>25.916G</td>
<td>Research Project in Hydrogeology</td>
</tr>
</tbody>
</table>
### Applied Science

#### Recommended Core Subjects
- 8.842G Groundwater Hydrology
- 8.860G Investigation of Groundwater Resources 1
- 8.861G Investigation of Groundwater Resources 2
- 25.325 Engineering and Environmental Geology
- 25.702G Hydrogeology
- 25.711G Arid Zone Engineering Geology

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
- 8.878G Flood Design II
- 8.879G Flood Design III
- 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
- 27.171G Directed Problems in Remote Sensing
- 27.174G Remote Sensing Instrumentation and Satellite Programs
- 27.922G Applied Geomorphology
- 27.914G Terrain Evaluation
- 27.910G Geomorphology of Arid Lands
- 27.911G Soil Erosion and Conservation
- 27.913G Terrain Evaluation
- 27.914G Research Project
- 27.950G Project or
- 27.951G Research Project

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.

#### Terrain Management

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

#### Compulsory Subjects†
- 25.702G Hydrogeology
- 25.707G Geopollution Management
- 25.711G Arid Zone Engineering Geology
- 25.712G Project in Terrain Management
- 25.713G 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
- 8.875G Hydrological Processes
- 27.043G Remote Sensing Applications
- 27.171G Directed Problems in Remote Sensing
- 27.174G Remote Sensing Instrumentation and Satellite Programs
- 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 field work, probably at Fowlers Gap Research Station.

*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 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
- 27.950G Project or
- 27.951G Research Project

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
- 8.875G Hydrological Processes
- 27.043G Remote Sensing Applications
- 27.171G Directed Problems in Remote Sensing
- 27.174G Remote Sensing Instrumentation and Satellite Programs
- 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 field work, 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
27.950G Project or
27.951G Research Project

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‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
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 field work, probably at Fowlers Gap Research Station.
‡Includes up to one week of field work at Fowlers Gap Research Station.
*Includes a field exercise of at least two weeks 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 MAAppSc degree 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 Department 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 MAAppSc degree 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
27.950G Project

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‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
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 field work, probably at Fowlers Gap Research Station.
§Includes up to one week of field work 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†

25.711G Arid Zone Engineering Geology*
25.712G 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 Department 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.
Applied Science

Optional Subjects
8.875G Hydrological Processes
25.702G Hydrogeology
25.707G Geopollution Management
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
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 field work, 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 Subjects†
27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
27.950G Project

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‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.914G Terrain Evaluation
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 field work, probably at Fowlers Gap Research Station.
†Includes up to one week of field work at Fowlers Gap Research Station.
‡Includes up to one week of field work 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‡
9.206G Project in 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 Department of Wool Science 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 2
9.202 Pastoral Agronomy
9.421 Animal Nutrition
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
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 Animal Science.
†Includes up to one week of field work 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 Department of Wool Science 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 3
9.131 Animal Health 1
9.132 Animal Health 2
9.202 Pastoral Agronomy
9.301 Agricultural Economics and Management 1
9.302 Agricultural Economics and Management 2
9.421 Animal Nutrition
9.503 Wool Science 3
9.504G Wool Science

80
Graduate Programs in Remote Sensing

Programs are available leading to the award of:

- Master of Applied Science in Remote Sensing: Course 8026
- Graduate Diploma in Remote Sensing: Course 5026

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 depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Four-year degree of appropriate standard in engineering, 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.

<table>
<thead>
<tr>
<th>Compulsory Subjects</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.043G Remote Sensing Applications</td>
<td>3</td>
</tr>
<tr>
<td>29.600G Principles of Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>29.602G Remote Sensing Procedures</td>
<td>3</td>
</tr>
<tr>
<td>29.605G Ground Investigations for Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>97.580G Image Analysis in Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>97.581G Microwave Remote Sensing</td>
<td>3</td>
</tr>
</tbody>
</table>

Project

- 46.101G Project in Remote Sensing or
- 46.102G Research Project in Remote Sensing

5026 Remote Sensing Graduate Diploma Course

Graduate Diploma GradDip

The graduate diploma program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Three-year degree from an approved university and/or qualifications deemed appropriate by the relevant faculty.

Course requirements. Candidates are required to complete a program totalling a minimum of 30 credits or equivalent to 15 hours per week for two sessions of full-time study, made up of compulsory subjects (15 credits) and elective subjects (15 credits). Compulsory subjects not offered in a particular year may be substituted by an approved equivalent subject. The course will normally comprise one year of full-time study or two years part-time study. One-third of the credits for elective subjects may be from approved undergraduate subjects.

<table>
<thead>
<tr>
<th>Compulsory Subjects</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.600G Principles of Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>29.605G Ground Investigations for Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>27.174G Remote Sensing Instrumentation and Satellite Programs</td>
<td>3</td>
</tr>
<tr>
<td>27.043G Remote Sensing Applications</td>
<td>3</td>
</tr>
<tr>
<td>97.580G Image Analysis in Remote Sensing</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective Subjects

From the following (or as approved by the relevant Faculty):

- 6.468G Computer Display Systems and Interactive Instrumentation
- 8.875G Hydrological Processes
- 8.849G Irrigation

Project

- 46.101G Project in Remote Sensing
- 46.102G Research Project in Remote Sensing
Graduate Program in Environmental Studies

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 Research Project (10 credits)
- Project (10 or 20 credits)
- Electives (10 or 20 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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.202G</td>
<td>Environmental Planning and Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>36.945G</td>
<td>The Organization of Town Planning</td>
<td>3</td>
</tr>
<tr>
<td>46.203G</td>
<td>Medical Aspects</td>
<td>2</td>
</tr>
<tr>
<td>46.204G</td>
<td>Legislative Aspects</td>
<td>2</td>
</tr>
</tbody>
</table>

### Project

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.200G</td>
<td>Research Project in Environmental Studies</td>
<td>20</td>
</tr>
<tr>
<td>or</td>
<td>46.201G  Project in Environmental Studies</td>
<td>10</td>
</tr>
</tbody>
</table>

### Elective Subjects*

#### Earth Science — Engineering

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.021</td>
<td>Environmental Aspects of Civil Engineering</td>
<td></td>
</tr>
<tr>
<td>8.847G</td>
<td>Water Resources Policy</td>
<td>3</td>
</tr>
<tr>
<td>25.704G</td>
<td>Environmental Geology</td>
<td>3</td>
</tr>
<tr>
<td>25.707G</td>
<td>Geopollution Management</td>
<td>3</td>
</tr>
<tr>
<td>25.710G</td>
<td>Coastal Environmental Geology</td>
<td>3</td>
</tr>
<tr>
<td>27.043G</td>
<td>Remote Sensing Applications</td>
<td>3</td>
</tr>
<tr>
<td>27.133</td>
<td>Pedology</td>
<td>5</td>
</tr>
<tr>
<td>27.171G</td>
<td>Directed Problems in Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>27.174G</td>
<td>Remote Sensing Instrumentation and Satellite Programs</td>
<td>3</td>
</tr>
<tr>
<td>27.183</td>
<td>Geomorphology</td>
<td>5</td>
</tr>
<tr>
<td>27.902G</td>
<td>Meteorological and Hydrological Principles</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Chemistry — Biology*

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.043A</td>
<td>Environmental Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>2.251G</td>
<td>Toxicology, Occupational and Public Health Animals</td>
<td>2</td>
</tr>
<tr>
<td>9.424G</td>
<td>Minerals and Their Effects on Grazing Animals</td>
<td></td>
</tr>
<tr>
<td>27.143</td>
<td>Biogeography</td>
<td>5</td>
</tr>
<tr>
<td>27.153</td>
<td>Climatology</td>
<td>5</td>
</tr>
<tr>
<td>42.212G</td>
<td>Principles of Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>43.142</td>
<td>Ecology and Environmental Botany</td>
<td>6</td>
</tr>
<tr>
<td>48.063G</td>
<td>Industrial Water and Wastewater</td>
<td>3</td>
</tr>
<tr>
<td>48.385G</td>
<td>Unit Operations in Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>48.391G</td>
<td>Atmospheric Pollution Control</td>
<td>3</td>
</tr>
<tr>
<td>48.392G</td>
<td>Practical Aspects of Air Pollution Measurement and Control</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Social-Economic-Planning*

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.402G</td>
<td>Transport, Environment, Community</td>
<td>6</td>
</tr>
<tr>
<td>8.403G</td>
<td>Theory of Land Use/Transport Interaction</td>
<td></td>
</tr>
<tr>
<td>27.923G</td>
<td>Population, Health and Environment</td>
<td>2</td>
</tr>
<tr>
<td>30.935G</td>
<td>Organization Behaviour A</td>
<td>3</td>
</tr>
<tr>
<td>30.958G</td>
<td>Organizational Communications</td>
<td>3</td>
</tr>
<tr>
<td>30.960G</td>
<td>Technology and Organizations</td>
<td>3</td>
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<tr>
<td>36.311</td>
<td>Environmental Psychology</td>
<td>4</td>
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<tr>
<td>37.3015</td>
<td>Environmental Impact Assessment 1</td>
<td>2</td>
</tr>
<tr>
<td>37.3016</td>
<td>Environmental Impact Assessment 2</td>
<td>2</td>
</tr>
<tr>
<td>37.160G</td>
<td>Land Systems</td>
<td>3</td>
</tr>
<tr>
<td>37.170G</td>
<td>Land Management</td>
<td>2</td>
</tr>
<tr>
<td>37.9105</td>
<td>Landscape Planning 1</td>
<td>4</td>
</tr>
<tr>
<td>37.9206</td>
<td>Landscape Planning 2</td>
<td>4</td>
</tr>
<tr>
<td>39.908G</td>
<td>Community Noise Control</td>
<td>2</td>
</tr>
<tr>
<td>85.716G</td>
<td>Public Policy</td>
<td>3</td>
</tr>
<tr>
<td>85.721G</td>
<td>Economics of Natural Resources</td>
<td>2</td>
</tr>
</tbody>
</table>

* Other subjects may be added on approval of Course Co-ordinator.
Subject Descriptions

Undergraduate Study

For Information Key refer to page 8

27.010 Land Studies S1 L2T2
Concepts, significance and problems of land. Land as territory and land as resource in Australia. Constraints imposed by the physical environment on human occupancy and settlement patterns, the variety of conflicts that result and management strategies. Practical work involves study of the ways in which the attributes and characteristics of land are displayed on maps, air photos and satellite imagery, and introduces these as basic information sources and research tools in applied geography.

27.020 Locational Processes S2 L2T2
Basic theoretical constructs for explaining the location of human activity. Concepts of optimal location and spatial competition, geographical variations in the factors of production, economies of scale and agglomeration, transaction costs and locational decision making under conditions of uncertainty. Practical study links theory and problem solving in economic geography.

27.030 Environmental Processes S2 L2T2
Essential and continuing links between components of the physical environment. Movement of energy and matter in the physical environment, including consideration of Earth’s energy balance, the hydrological cycle, nutrient cycles in vegetation and soil, imbalances leading to land degradation and instability, alternatives to and movement of materials.

27.040 Data Processing Systems F T2
Measurement, processing and display of spatial data. Basic knowledge and skills for using the University’s computing system effectively; the use of computer software packages in geographic enquiry; exploratory data analysis and graphic information processing; and the presentation of data in tables, graphs and diagrams.

27.050 Geographical Data Analysis F L2T2
Prerequisite: 27.030. Excluded: 27.162, 27.632, 27.813, 27.884.
Inferential statistics and hypothesis testing in the analysis of spatial data. Methods of analysing categorical data, identifying spatial correlation and associations, and multivariate methods applicable to topics in physical and economic geography.

27.100 Field Project 1 S2 T3
A five days field project normally undertaken during the mid-year recess, designed to support teaching in Year 1 (Level 1) subjects and to develop basic field methods and skills. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

27.133 Pedology S2 L2T3
Prerequisites: 27.010 and 27.030 or any two units from 2.111, 2.121, 2.131, 2.141, and 27.818, 27.828 or 25.012 or 25.022.
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. The use of soil micromorphological and mineralogical studies in pedology.

27.143 Biogeography S1 L2T3
Prerequisites: 27.030 or 27.828 or 17.031 and 17.041 or 27.111 or 27.172.

27.153 Climatology S1 L2T3
Prerequisites: 1.001 or 27.030 or 27.828 or 25.110 and 25.120 or 17.031 and 17.041.
### 27.175 Introduction to Remote Sensing  
**Prerequisite:** Successful completion of a Year 1 program in Applied Science, Science or Arts (or equivalent) as approved by the Head of School.

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for interpretation. Basic air photo-interpretation techniques relevant to environmental assessment. Introduction to principles of the electromagnetic spectrum, photometry, and radiometry. Sensor types, image formation and end products associated with selected satellite programs, including Landsat. Land-cover and land-use interpretation procedures in visual image analysis. Basic procedures in machine-assisted image enhancement.

### 27.176 Remote Sensing Applications  
**Prerequisite:** 27.175 or 27.1711, 29.514 or 29.511 and 29.631. Excluded: 27.1712

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multitemporal sampling procedures, image to image registration and map to image registration. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

### 27.180 Field Project

Develop skills in problem formulation and team-based field work. Preparation and presentation of professional quality reports of applied geographical analysis. Define problem, plan strategy for appropriate investigation. Conduct field studies, and report results of investigation. Field work of five days is compulsory. Students will incur some personal expenses in connection with this subject.

### 27.183 Geomorphology  
**Prerequisites:** 25.110 and 25.120 or 27.010 and 27.030 or 27.828. Excluded: 27.880.

Hillslope materials, processes and form; models of slope and landscape evolution. Fluvial geomorphology including water movement and sediment transport in river channels, hydraulic geometry, channel patterns, river types, floodplain formation, alluvial fans, river channel changes. Erosional and depositional landforms in coastal, arid, humid and glacial environments. Field work in fluvial and hillslope geomorphology, and laboratories on field measurements of geomorphic processes, sediment analyses and airphotograph interpretation.

### 27.190 Assessment of Human and Physical Resources  
**Prerequisites:** 27.030 or 27.818 or by permission from Head of School.

Assessments of human and physical resources and environments. Specialised study in the following areas: landforms, soils, vegetation, climate and water, resource planning and decision making, human resources, geographical thought and perspectives. Since the units offered in any one year may be affected by the availability of staff, students should obtain information from the School.

### 27.193 Environment Impact Assessment

**Prerequisites:** 27.030 or 27.818 or by permission from Head of School.

Rationale and basic objectives; standardized types of environmental impact assessment (EIA), including matrix approach, adopted methods of EIA in Australia. Frequently used assessment and predictive techniques for meteorological, hydrological, biological, socio-economic impacts. Techniques of impact evaluation in terms of socio-economic criteria. Environmental decision making and planning under conditions of uncertainty. Case studies exemplifying procedures, techniques and issues. Trends, changes and possible future developments in EIA. Practical exercises representing components of typical EIAs.

### 27.200 Field Project 2

A five days field project normally undertaken during a recess designed to support teaching in Year 2 subjects in physical and economic geography and to develop more advanced skills in data collection, observation and field methods. Students will incur personal expenses in connection with this subject, which is a compulsory part of the course.

### 27.213 Soils and Landforms

**Prerequisite:** 27.133 or 27.183 or 27.828


### 27.223 Environmental Change

**Prerequisite:** Successful completion of a Year 2 Programme in Applied Science, Science, or Arts or equivalent as approved by the Head of School.


### 27.230 Field Project 3

A five days field project normally undertaken during a recess, designed to support teaching in Year 3 (Level III) subjects in physical and economic geography and to demonstrate the application of field methods in problem solving and research projects. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

### 27.431 Computer Cartography

**Prerequisites:** 27.030 or 27.818 or by permission from Head of School.

Theoretical and practical problems in producing thematic maps by computer. Effective use of colour and shading on thematic maps. Design principles. Data entry and digitising. Production of multiple feature displays. Use of symbolism. Emphasis on developing skills in computer cartography through hands-on experience.
27.432 Computer Mapping and Data Display  S1 L1T3
Prerequisites: Successful completion of a Year 1 program in Science or Arts (or equivalent) as approved by Head of School.

Introduction to theoretical and practical problems in displaying data graphically and constructing thematic maps by computer using the GIMMS mapping package. The emphasis is on developing skills in automated cartography through hands-on experience culminating in the preparation of a folio of maps of selected census data. No previous computing expertise is required.

27.500 Mathematical Methods for Spatial Analysis  S1 L2T2
Prerequisite: 10.021B and 10.021C (or 10.001 or 10.011) and 27.040 or 13.200

Selected mathematical methods for the analysis of spatial problems, including applications of calculus in constrained and unconstrained optimisation; mathematical programming methods; network models; input-output analysis; in facility location and allocation problems.

27.503 Project Design and Formulation  S2 L1T3
Stages in the design of a research project. Undertaking a literature review relating to the project. Identification and formulation of working hypotheses. Writing up a research proposal. Timetables and planning strategies for project execution and completion.

27.504 Project  S1 T16
Prerequisite: 27.503

Implementation of the research proposal in Applied Geography prepared for 27.503 Project Design and Formulation under the direction of a supervisor; preparation of a project report.

27.510 Project in Spatial Analysis  S2 L1T3
Prerequisite: 27.500.

Supervised application of quantitative methods in selected projects involving the analysis of spatial data and requires integrated applications of skills in data processing, geographic data analysis, and mathematical methods.

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; applying for positions and personal skills development.

27.520 Regional Theory  S1 L2T2
Prerequisite: 27.020.

Regional theory and analytical methods with a particular focus on the explanation of the Richardson growth model and the practical application of its components, using Australian data. Capital formation and mobility, labour supply and technological change, assessments of recent changes in the Australian regional economic system. Practical work deals with the measurement and analysis of structural change, accessibility and economic interaction and regional economic welfare.

27.524 Advanced Spatial Analysis  S2 L2T2
Selected topics in economic and physical geography chosen to illustrate developments at the frontiers of research in spatial analysis.

27.534 Advanced Environmental Analysis  S2 L2T2
Selected topics in the study of human and physical environments, chosen to illustrate contemporary frontiers of research and development in environmental studies.

27.633 Geographic Data Analysis 3  S2 L2 T2
Advanced methods for spatial analysis; case studies; selected topics in applied economic geography with particular reference to urban and regional analysis and planning.

27.643 Sample Surveys and Questionnaire Design  S1 L2T2
Explanation and prediction as distinct research objectives; designing research to achieve reliability and validity; case studies in research design; questionnaire design and implementation; scaling methods; interviewing techniques; sampling problems; directions in Qualitative Research.

27.652 Geographic Information Systems  S2 L2T2
Prerequisites: 10.021B and 10.021C, or 10.001 or 10.011 or 27.432.

An introduction to information systems of particular relevance for geographers with special reference to computer-based systems for resource evaluation. Case study evaluation, application of the MAP and other GIS software.

27.672 Transport and Land Use  S1 L2T2
The relationships between transport and land use, mobility, accessibility, and activity systems in urban and rural environments. Emphasis on policy issues and case studies from Australia. Introduction to simple transport-land use models.

27.713 Marketing Geography  S2 L2T3
Prerequisite: 28.042. Note: This prerequisite does not apply to students enrolled in course 3010.

Organization and operation of the marketing function and trends in its performance. Merchandising strategies of wholesalers and retailers and the consequent location patterns of consumer-oriented enterprises within cities. Retail feasibility studies and the structure and analysis of market areas in intra-urban areas. Consumer spatial behaviour, including search and decision processes. Shopping centre images and spatial choice models.
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 population forecasting is handled within the framework of demographic theory and component analysis; migration analysis is given particular attention; multi-region population models; hybrid methods of small area population forecasting; use of population profiles for planning the provision of services.

27.753 Social Welfare and Urban Development  
S1 L2T2
Prerequisite: 27.829. Note: This prerequisite does not apply to students enrolled in course 3010.
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.

Servicing Subjects
These are additional subjects taught within courses offered by other Faculties.

For further information regarding the following subjects see the Faculty of Architecture, Arts, Commerce, Engineering and Combined Sciences Handbooks.

27.813 Geographic Methods  
S2 L2T2
Prerequisites: 27.010 and 27.030, or 27.818 and 27.819. Excluded: 27.050, 27.813.
Statistical procedures and field methods used in both human and physical geography. Includes: measures of dispersion; measures of spatial distribution; samples and estimates; correlation and regression; tests for distribution in space; data collection and analysis; field observations.

Three days field work is a compulsory part of the subject and students will incur some personal expenses with this.

27.818 Australian Environment and Human Response  
S1 L2T2
Characteristics of the Australian environment viewed in global context. Topics include: the structure, function and origin of the lithosphere, hydrosphere and biosphere; the plate tectonic model and major landforms; atmospheric circulation, energy and radiation balances; the hydrological cycle; floods and droughts; characteristics and distribution of soils and vegetation; analysis of ecosystems. A one day field trip is compulsory. Students will incur some personal expenses in connection with this subject.

27.819 Technology and Regional Change  
S2 L2T2
Prerequisite: Nil. Excluded: 27.802.
The impact of technological change on the spatial organization of human activities and regional development and disparities.

27.824 Spatial Population Analysis  
S2 L2T2
Prerequisite: 27.829. Excluded: 27.834.
Population growth and structure in an international urban and regional context. The components and processes of population change; fertility, mortality and migration set within the framework of demographic transition and development theory. Theories of migration and mobility and of optimal populations. Demographic and social indicators for urban and regional analysis and their implications for inequalities in living conditions, at local, regional, and international scales. The adjustment of immigrant and migrant populations to the urban environment.

27.825 Urban Activity Systems  
S1 L2T2
Prerequisite: 27.829. Excluded: 27.835, 27.812.
Focus is on trip making, movement, and activity patterns in urban areas. Topics include: the activity concept, travel behaviour and urban spatial structure; constraints to individual travel behaviour and activity pattern linkages; the urban transport disadvantaged; public transport problems and issues in Australian capital cities; travel and activity consequences of transport infrastructure developments.

27.826 Urban and Regional Development  
S2 L2T2
Prerequisite: 27.829. Excluded: 27.836, 27.812.
Theories of urban and regional change leading to assessment of the role of planning. Emphasis on resource allocation, conflict resolution and evaluation techniques including cost-benefit analysis and environmental impact assessment. Examples are taken principally from the fields of recreation and tourism.

27.828 Australian Natural Environments  
S2 L2T2
Prerequisite: 27.818 or 27.030. Excluded: 27.111, 27.611, 27.183.
Characteristics, origin and development of environments in Australia in terms of their tectonic history, lithology, landforms, climate, vegetation and soils. Analysis of natural physiographic regions and their modification by man. A two day field trip is compulsory. Students will incur some expenses in connection with this subject.

27.829 Australian Social Environments  
S1 L2T2
Prerequisite: 27.819. Excluded: 27.010, 27.030, 27.812.
Focus is on the interaction between human communities and the built environment in Australia: the effects of the natural environment on the evolution of settlement patterns; detailed analysis
of rural and metropolitan social environments. Emphasis on inner
city, suburbia, behavioural and social area approaches, and to
managerialist and structural theories of social change on areas
and their communities.

27.844 Honours Geography

Prerequisites: Arts students must satisfy Faculty requirements for entry to
the Honours Level program and must have obtained at least 54 credit
points in Geography subjects, including 12 Level 1 credit points. A min-
imum cumulative average at Credit level is required for all Upper Level
subjects taken which must include 27.884.

Details of Honours Geography for science students are avail-
able from the School of Geography office.

Students are required: 1. To undertake an original piece of work
extending throughout the year and to submit a thesis based
upon it. 2. To participate in seminars and fieldwork as notified
by the School of Geography.

27.862 Australian Environment and
Natural Resources S1 L2T2

Prerequisite: 27.030 or 27.816 or 27.829. Excluded: 27.872.

Continental and regional patterns of land, water and energy
resources in Australia and its territorial waters, and natural fac-
tors affecting their development, including climate, soils and
terrain; problems of limited surface and underground water
resources and of conflicting demands, exemplified through par-
ticular basin studies; comparable reviews of energy, minerals and
forest resources, human resources and development.

27.883 Special Topic S1 or S2 T4

Prerequisite: Nil.

Admission by permission to suitable students with good Passes
in at least four subjects at Upper Level. A course of individually
supervised reading and assignments as an approved topic in
Geography not otherwise offered.

27.884 Advanced Geographic Methods S1 L2T2

Prerequisites: 27.813. Excluded: 27.050, 27.880.

Additional quantitative research techniques normally taken by
Honours students in their third year. Research organization;
computer analysis; collection and organization of data; statisti-
cal description; hypothesis testing and sampling; simple and
multiple association analysis; nonparametric methods.

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; multitemporal monitoring and inventory of range-
lands, croplands and forests; rural and urban land use assess-
ment; surveillance of surface water resources and sedimentation;
appraisal of changes in the coastal zone. Use of remote sen-
sing in environmental management and in environmental impact
assessment.

27.171G Directed Problems In
Remote Sensing S2 T3 C3

A detailed investigation of a particular aspect of remote sensing
technology or an area of applications relevant to candidates
interests and background.

27.174G Remote Sensing Instrumentation
and Satellite Programs S1 L2T1 C3

Aircraft and satellite platforms; sensor types; image formation
and end products including panchromatic, colour, colour IR and
thermal IR photographic products, microwave imagery and
computer tape products. The organization, acquisition, process-
ing and analysis of imagery obtained from the following satellite
programs: Landsat, Skylab, Heat Capacity Mapper Mission,
Geodynamics Experimental Ocean Satellite, NOAA-9, Nimbus
Coastal Zone Color Scanner, Seasat, Space Shuttle, Spot and
Soyuz-Salyut.

27.202G Environmental Planning and Evaluation C3

Lectures and seminars on environmentalism and political econ-
omy, environmental information, impact assessment, and eco-
nomic evaluation.

27.644G Computer Mapping and Data Display C3

Introduction to automated cartography and thematic mapping;
thoretical and practical problems in displaying and mapping
data by computer; review and application of selected computer
mapping packages. INFO is used for database management, and
ARC-INFO and GIMMS for cartographic manipulation and
output.

27.672G Geographic Information Systems C3

Study of selected geographic information systems; problems of
data capture and display, data storage and manipulation, sys-

Undergraduate Study: Subject Descriptions

1. Meteorology: Heat and water balances of earth-atmosphere
system. Global pressure, wind and climatic patterns. Atmos-
pheric stability, temperature inversions, aerological diagrams.
Synoptic and local and wind systems, dispersal of atmospheric pol-
27.910G Geomorphology of Arid Lands S2 L2T4 C6

27.911G Soil Erosion and Conservation S1 or S2 L2T4 C6

27.912G Arid Zone Climatology S1 L2T4 C6
Definitions of aridity based on climatic data and their relevance at different scales from hydrologic and biologic considerations. Methods 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 is 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 alkalinization. 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 Pedology, with additional reading, tutorials, seminars and practical classes to stress the features of arid zone soils.

The formal component of the above teaching is 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 L2T4 C6
Principles and techniques for natural resource surveys and land evaluation including: land systems, pattern and structure, land capability and economic aspects of evaluation; examination of mapping, taxonomic and descriptive units; the problem of map scale and accuracy; styles of presentation for practitioners and other users. Application of principles in selected other contexts.

27.922G Applied Geomorphology S2 L1½T½ C3
Landform expression of lithology and structure, Hillslope, drainage basin and channel forms and processes. Landform evolution, short-term and long-term geomorphic changes. Geomorphological background to soil erosion, stream channel, floodplain and coastal engineering problems. Geomorphological approach to terrain evaluation. Exercises in airphoto and map analysis of fluvial landforms or terrain types. Field excursion on fluvial landform or terrain assessment, as required.

27.923G Population, Health and Environment C2
Relationship between environmental factors and disease morbidity and mortality is examined by consideration of the epidemiological transition in different countries, and the spatial and occupational-specific variation in disease incidence in Australia. Methodology for standardising, testing for significance and data quality.

27.950G Project S2 T9 C9
A practical application or investigation in land classification as a basis for land management or land-use planning; or an investigation of soil degradation in relation to soil-vegetation characteristics and land use; or a comparative review of existing approaches to land evaluation. Involves preparation of a report, and fieldwork at Fowlers Gap Research Station or in another part of arid or semi-arid Australia. Tutorial hours are equivalent contact hours, but also involve fieldwork out of session.

27.951G Research Project F T9 C18
As for 27.950G Project, but involving more substantial research over a longer period. Tutorial hours are equivalent contact hours,
but may also involve fieldwork out of session.

Remote Sensing

46.101G Project in Remote Sensing C9
A minor study of some aspects of remote sensing as it relates to investigations within a particular discipline or subject area offered by Schools within the Faculty of Applied Science.

46.102G Research Project in Remote Sensing C18
An investigation of a problem in remote sensing which involves an identifiable research-component. Such an investigation should be related to the research interests of particular Schools within the Faculty of Applied Science.

Environmental Studies

46.200G Research Project in Environmental Studies C20
Research investigation on an approved topic, conducted either individually or as part of a team.

46.201G Project in Environmental Studies C10
As for 46.200G but involving a smaller research task.

46.203G Medical Aspects C2
Aspects of medicine bearing upon physiological consequences of pollutants. Synergism and antagonisms, 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 Legislative Aspects C2
School of Materials Science and Engineering
At the basis of most of the technological advances of recent years, the explosion in new highly sophisticated materials is transforming everything in our manufactured environment, from the humble set of scissors to jet aircraft and America's Cup yachts. New advanced ceramics — lighter, harder and more stable at high temperatures than any metal — are finding applications in motor vehicle engines, electronics components and surgical implants. Manufacturers are looking to these and other sophisticated materials to meet the demands of the new high tech industries (such as lasers, electronics and fibre optics), or in the quest for enhanced fuel economy, durability or fabrication streamlining in their products.

Materials Science has been designated as a primary area for increased investment by the Federal Government. In order to meet the expected growth of the materials industry in Australia, particularly in the more sophisticated applications such as electronic and electrical ceramics, high temperature materials, surface coatings, machine tool materials and engineering polymers, increases in the number of graduates and postgraduates are anticipated over the coming decade. In addition, if Australia is to be competitive in the area of advanced materials, the materials manufacturing industry in this country will have to be developed and restructured, and this can be expected to also create new positions for materials graduates.

The School of Materials Science and Engineering is in a good position to provide the increased numbers of graduates necessary for development of these new initiatives in materials. It is the only school in Australia which offers professional courses in both ceramic engineering and metallurgical engineering as well as providing postgraduate specialists in these fields. The School is extremely well equipped with a wide range of advanced computing, mechanical testing, X-ray, optical and electron microscopy facilities.

The School comprises three departments; ceramic engineering and metallurgical engineering which offer the above-mentioned undergraduate courses, and materials engineering which is responsible for materials servicing activities and for the development of a new degree materials and management.

Ceramic Engineering and Ceramics

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 stu-
The undergraduate courses in metallurgical engineering and the metal industry provide opportunities for a career in management of metallurgy within the metal and manufacturing industries or in metallurgy. These courses are broadly based on the physical sciences and have considerable scope in various government, university, and industrial 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, e.g., the Australian Nuclear Science and Technology Organisation, and the Divisions of Materials Science and Building Research of CSIRO. Investigation 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.

Graduate metallurgists have a wide choice of type of employment and location. They may work in production, technical control or development, in metal or mineral producing plants in locations such as Newcastle, Port Kembla, Broken Hill, Mt Isa, Townsville, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in manufacturing plants, including the automobile, aircraft, construction industries located mainly in the population centres. In the metal industry 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 metallurgical engineering and metallurgy are broadly based on the physical sciences and have been designed to prepare graduates for employment in any field of metallurgy within the metal and manufacturing industries or in research institutions.

These courses meet the formal educational requirements for admission to the professional institutes, such as the Australasian Institute of Mining and Metallurgy and the Institution of Metals and Materials Australasia.

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**Staff**

**Associate Professor and Head of School**
David John Young, BSc PhD Melb., FRACI, MAmeriChe

**Professor of Materials Science**
Vacant

**Professor of Physical Metallurgy**
Vacant

**Associate Professor**
David John Haviland Corderoy, BSc N.S.W., PhD Sheff., CEng, FIMA, MWeld(Lond), MIEAust, MAusIMM

**Senior Lecturers**
Sydney Blair, BSc PhD Manc., FIMMA
Bruce Harris, BSc Syd., MSc N.S.W. MAusIMM
Peter Krauklis, BSc PhD N.S.W. CEng., MIMMA
Peter George McDougall, BSc PhD N.S.W., ASTC, CEng, MIMMA
Michael Bernard McGirr, BSc Syd., PhD N.S.W.
Savitslav Antonovich Prokopovich, MSc N.S.W., ASTC, CEng, MIEAust
Keith Robin Lee Thompson, BSc Wales, PhD N.S.W., CEng., MIMMA
John Maurice Wheatley, MA PhD Camb., CEng, FIMA, FAusWI, MWeld (Lond.)

**Lecturers**
Alan Gordon Crosby, BSc PhD N.S.W., MIMMA
Charles Christopher Sorrel BS Missouri, MS Penn, PhD N.S.W.
Pantcho Tomas, MSc PhD N.S.W.

**Honorary Visiting Professors**
Anthony Vernon Bradshaw, BSc Lond., CEng, ARSM FTS, FIMM, MAusIMM
Eric Robert McCartney, BSc Syd., PhD N.S.W., FICeram, MIEAust, ARACI

**Honorary Associate**
Max Hatherly, MSc PhD N.S.W., ASTC, FTS, CEng, FIM

**Professional Officers**
Bernard James Baggaley, MSc PhD N.S.W., DipCer N.Stffs Poly
Frederick Henry Scott, BSc N.S.W., MAIP
John Walton Sharp, BSc(Tech) N.S.W.

**Administrative Assistant**
Ole Staer Andersen, Magr Copenhagen, MGenStud N.S.W.
Course Outlines

Undergraduate Study

Ceramic Engineering and Ceramics

A four-year full-time course in Ceramic Engineering leading to the award of the BE degree and a six-year part-time course in Ceramics leading to the award of the BSc(Tech) degree are offered within the School.

3025
Ceramic Engineering — Full-time Course
Bachelor of Engineering
BE

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Year 3

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Year 4

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*Project includes 42 hours of laboratory work during the mid year recess.

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

<table>
<thead>
<tr>
<th>Stages 1 and 2*</th>
<th>Hours per week</th>
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*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.
Metallurgical Engineering

A four-year full-time course in metallurgical engineering leading to the award of the BMetE degree and a six-year part-time course in metallurgy leading to the award of the BSc(Tech) degree are offered within the School.
This course is designed for students who are employed in the metallurgical and manufacturing industries and extends over six part-time years of study. Some of the subjects of stages 3, 4, 5 and 6 may be available only in day-time classes, and up to one day of release from industry per week may be required. The course essentially covers the same subject matter as the first days of release from industry per week may be required. The course of study.

Undergraduate Study: Course Outlines

### Year 3

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<td>4.413 Physical Metallurgy 2A</td>
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<td>4.433C Physical Metallurgy 2C</td>
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<td>4.443 Physical Metallurgy 2D</td>
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<td>4.453 Physical Metallurgy 2E</td>
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<td>4.613A Metallurgical Engineering 2A</td>
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<td>4.623B Metallurgical Engineering 2B</td>
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<td>4.633 Metallurgical Engineering 2C</td>
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<tr>
<td>4.643 Metallurgical Engineering 2D</td>
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<tr>
<td>4.713 X-ray Diffraction and Electron Microscopy</td>
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<td>6.854 Electrical Power Engineering</td>
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<td>7.735 Chemical and Extraction</td>
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**Stage 1**

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**Stage 2**

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<td>2.131 Chemistry 1B</td>
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<td>5.0011 Engineering Mechanics 1</td>
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<td>5.0012 Introductory Engineering Design and Materials Science</td>
<td>S1: 2, S2: 0</td>
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<tr>
<td>5.0302 Engineering Drawing and Descriptive Geometry</td>
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*There are no evening lectures in this subject.

### Year 4

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<td>4.044 Professional Electives</td>
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<td>4.054 Materials Seminar</td>
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<td>4.414 Physical Metallurgy 3A</td>
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<td>4.424 Physical Metallurgy 3B</td>
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<td>4.614 Metallurgical Engineering 3A</td>
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<tr>
<td>4.624B Metallurgical Engineering 3B</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>4.634 Metallurgical Engineering 3C</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>4.644 Metallurgical Engineering 3D</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>4.654 Metallurgical Engineering 3E</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>General Education</td>
<td>S1: 25, S2: 25</td>
</tr>
</tbody>
</table>

**Stage 3**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.102A Physical Chemistry</td>
<td>S1: 6, S2: 0</td>
</tr>
<tr>
<td>4.422B Physical Metallurgy 1B</td>
<td>S1: 0, S2: 2</td>
</tr>
<tr>
<td>4.712 Materials Engineering 1A</td>
<td>S1: 3 1/2, S2: 0</td>
</tr>
<tr>
<td>4.742 Physics of Materials</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>7.725 Chemical and Extractive Metallurgy</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>10.031 Mathematics</td>
<td>S1: 2, S2: 2</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1: 13 1/2, S2: 12</td>
</tr>
</tbody>
</table>

### Stage 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td>1.9222 Electronics</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>4.412A Physical Metallurgy 1A</td>
<td>S1: 6, S2: 0</td>
</tr>
<tr>
<td>4.432 Physical Metallurgy 1C</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>4.642 Metallurgical Engineering 1D</td>
<td>S1: 0, S2: 2</td>
</tr>
<tr>
<td>4.722 Materials Engineering 1B</td>
<td>S1: 0, S2: 3 1/2</td>
</tr>
<tr>
<td>4.732 Mechanical Properties of Materials</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>General Education Subject</td>
<td>S1: 13, S2: 13</td>
</tr>
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</table>

### Stage 5

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.413 Physical Metallurgy 2A</td>
<td>S1: 2 1/2, S2: 0</td>
</tr>
<tr>
<td>4.443 Physical Metallurgy 2D</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>4.453 Physical Metallurgy 2E</td>
<td>S1: 0, S2: 2 1/2</td>
</tr>
<tr>
<td>4.613A Metallurgical Engineering 2A</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>4.633 Metallurgical Engineering 2C</td>
<td>S1: 3 1/2, S2: 3 1/2</td>
</tr>
<tr>
<td>4.643 Metallurgical Engineering 2D</td>
<td>S1: 0, S2: 3</td>
</tr>
<tr>
<td>4.713 X-ray Diffraction and Electron Microscopy</td>
<td>S1: 4, S2: 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.034 Industrial Metallurgy Project</td>
<td>S1: 4, S2: 2</td>
</tr>
<tr>
<td>4.054 Materials Seminar</td>
<td>S1: 2, S2: 2</td>
</tr>
<tr>
<td>4.433C Physical Metallurgy 2C</td>
<td>S1: 4, S2: 0</td>
</tr>
<tr>
<td>4.624B Metallurgical Engineering 3B</td>
<td>S1: 3, S2: 0</td>
</tr>
<tr>
<td>4.644 Metallurgical Engineering 3D</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>4.654 Metallurgical Engineering 3E</td>
<td>S1: 0, S2: 4</td>
</tr>
<tr>
<td>6.854 Electrical Power Engineering</td>
<td>S1: 0, S2: 3</td>
</tr>
</tbody>
</table>

3130 Metallurgy — Part-time Course

**Bachelor of Science (Technology) BSc(Tech)**

This course is designed for students who are employed in the metallurgical and manufacturing industries and extends over six part-time years of study. Some of the subjects of stages 3, 4, 5 and 6 may be available only in day-time classes, and up to one days of release from industry per week may be required. The course essentially covers the same subject matter as the first three years and part of Year 4 of the full-time metallurgy course and involves the same major strands of study in Physical Metallurgy and Metallurgical Engineering. In the later stages of the course, there is less emphasis on primary metallurgy than in the full-time course and there is more emphasis on secondary Metallurgical Engineering which is developed to Year 4 level, while Physical Metallurgy is taken to Year 3 level. 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 approval of the Head of School may be completed after completion of the prescribed course of study.
Graduate Study

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 or who are interested in programs involving formal course work and research leading to the award of Graduate Diploma in Materials.

Information about research scholarships, fellowships and grants-in-aid is available from the Head of School and graduates are advised to consult him before making a formal application for registration.

5035
Graduate Diploma in Materials

The course is designed to provide specialist professional training in Materials at an advanced level for graduates in related courses in Science, Applied Science or Engineering and is aimed at extending the primary disciplines in this regard.

The current emphasis is on metallic and ceramic materials but it is anticipated that other specializations may be offered. Subject to consultation, other subjects may be drawn from graduate subjects available from other Schools by approval from the Heads of both Schools.

Entry Qualifications

Applicants for admission to the course must be graduates of this University or other approved university or have other qualifications deemed appropriate by the university. However, Faculty may require an applicant to take such other prerequisite or concurrent studies and/or examinations as it may prescribe. It is expected that the first degree or other qualification contain mathematics, physics and chemistry to an acceptable level but students without these qualifications may be admitted subject to the approval of the Head of School or required to undertake a qualifying program.

In cases in which qualifying programs or bridging courses are required these can be designed to suit the needs of the individual candidates.

Course Requirements

Candidates are required to complete a program of formal study (including a Project) totalling 20½ hours per week over two sessions on a full-time basis, or 10 hours per week over four sessions on a part-time basis. The full-time program will comprise a minimum of 12 hours per week drawn from the graduate subjects as listed below.

Students are assessed by written examination in graduate subjects and professional electives. Marks are assigned to each component of the course according to the proportion of time spent in each graduate subject and professional elective.

The subjects in the graduate program shall comply with the following compulsory and elective subjects in which the professional electives are drawn from the undergraduate group of subjects comprising subject 4.044 Professional Electives with extensions as appropriate to the graduate level.

<table>
<thead>
<tr>
<th>Compulsory Subjects</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.044</td>
<td>Professional Electives</td>
</tr>
<tr>
<td>4.201G</td>
<td>Graduate Seminar</td>
</tr>
<tr>
<td>4.241G</td>
<td>Graduate Materials Project</td>
</tr>
<tr>
<td>4.633</td>
<td>Metallurgical Engineering 2C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective Graduate Subjects*</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.211G</td>
<td>Metallurgical Practice</td>
</tr>
<tr>
<td>4.221G</td>
<td>Advanced Metallurgical Techniques</td>
</tr>
<tr>
<td>4.231G</td>
<td>Advanced Theoretical Metallurgy</td>
</tr>
<tr>
<td>4.251G</td>
<td>Advanced Materials Technology</td>
</tr>
</tbody>
</table>

*The program selected by each student must be approved by the Head of School. Not all electives are offered each session, nor is the full range available each year. Subject to consultation other graduate subjects may be drawn from other Schools by approval from the Heads of both Schools.
Subject Descriptions

Undergraduate Study

4.001 Introduction to Materials Engineering S1 or S2 L1
Forms part of 5.0012.
Metals, ceramics, polymers and composites, their structure, chemical, physical and mechanical properties, engineering applications and production, with particular reference to Australian industries.

4.003 Introduction to Computing S2 L2
Introductory computing. Outline of computer architecture. Features of common computing languages, syntax, structure, variable typing, portability. Basic syntax. Common numerical techniques, function evaluation, Monte Carlo techniques; assignments involving application of these techniques.

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 S1 4 S2 2
An experimental investigation of some aspects of industrial metallurgy.

4.044 Professional Electives F5
A combination of the following electives giving a total of at least 140 hours over the whole year (28 weeks). The list of electives is:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.204</td>
<td>Ceramic Materials Selection</td>
<td>28</td>
</tr>
<tr>
<td>4.444</td>
<td>Advanced Crystallography of Phase</td>
<td>14</td>
</tr>
<tr>
<td>4.494</td>
<td>High Temperature Techniques</td>
<td>14</td>
</tr>
<tr>
<td>4.664</td>
<td>Surface Treatments and Wear</td>
<td>14</td>
</tr>
<tr>
<td>4.674</td>
<td>Mathematical Plasticity</td>
<td>14</td>
</tr>
<tr>
<td>4.684</td>
<td>Transport Phenomena in Metallurgical Processes</td>
<td>14</td>
</tr>
<tr>
<td>4.694</td>
<td>Air Pollution Control in the Metallurgical Industry</td>
<td>14</td>
</tr>
<tr>
<td>4.704</td>
<td>Design with Brittle Materials</td>
<td>42</td>
</tr>
<tr>
<td>7.7451</td>
<td>Advances in Pyrometallurgy</td>
<td>28</td>
</tr>
<tr>
<td>7.7452</td>
<td>Advances in Hydrometallurgy</td>
<td>28</td>
</tr>
<tr>
<td>7.748</td>
<td>Technical Decision Making</td>
<td>28</td>
</tr>
</tbody>
</table>

The program selected by each student must be approved by the Head of School. Not all electives are offered each session, nor is the full range available each year. Students are advised each year of the timetable of available electives.

4.054 Materials Seminar F L2
Lectures on the preparation and presentation of technical papers. Development of encoding and decoding communication skills in the various communication media. Chairpersonship.

4.202 Ceramic Process Principles 1 S1 L2
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.

4.204 Ceramic Materials Selection S1 or S2 L2

4.212 Phase Equilibria In Ceramics S1 L2 T1
Phase equilibria and thermodynamic basis of the phase rule. The one component system, the importance of pressure, polymorphism of solids. The two component system: the binary eutectic, intermediate compounds, continuous and partial solid solution, liquid immiscibility. Experimental and thermodynamic methods of constructing phase diagrams. Ternary systems without solid solutions in ternary systems. Non-equilibrium in ceramic systems. Introduction to quaternary and multicompontent systems.

4.213 Chemical Ceramics S1 L3T3 S2 L2T3
Prerequisites: 2.102A and 2.102C
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.

4.214 Electrical Ceramics S2 L1 T2
Prerequisite: 4.742

4.224 Physical Ceramics F L2T4
Prerequisites: 4.213
4.231 Introduction to Ceramic Engineering  
**S2 L2**

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 1  
**S1 L3**

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 L1T21/2**


Students are required to take part in a series of factory inspections.

4.234 Ceramic Engineering 2  
**F L2T2**


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.

4.412A Physical Metallurgy 1A  
**Unit 1: Phase Equilibria I**  
**S1 L3**

Co-requisite: 2.102A, 4.732.

Elements of crystallography. The crystal structure of metallic phases. Defect structures, dislocations, grain boundaries, plasticity, deformation and recrystallization. Phase equilibrium in alloy systems. Generation of microstructure. Mechanisms of phase transformations, departure from equilibrium, metastable transition phases. Use of free energy principles to determine nature of phase equilibrium, common tangent construction. Application of Hume-Rothery principles to determine liquidus and solidus boundaries, electron compounds. Introduction to nucleation theory.

**Unit 2: Phase Equilibria Laboratory**  
**S1 T3**


4.413 Physical Metallurgy 2A  
**S1 L1 T1½**

Prerequisite: 4.412A.


4.414 Physical Metallurgy 3A  
**S1 L2**

Prerequisite: 4.433C.


4.422B Physical Metallurgy 1B  
**S2 L1T1**


4.424 Physical Metallurgy 3B  
**S1 L½T1½**

Prerequisite: 4.713


4.432 Physical Metallurgy 1C  
**S2 L1T3**

Prerequisite: 4.412A.


4.433C Physical Metallurgy 2C  
**S1 L2½T1½**

Prerequisite: 4.412A.


4.434 Physical Metallurgy 3C  
**S2 L2T1**

Prerequisite: 7.735.

Structure and properties. Application of the chemistry of the defect solid state to materials preparation and reactivity. Non stoichiometry and stoichiometry dependent physical and chemi-
ical properties of metal compounds. Structure and properties of ionic and metallic melts.

4.443 Physical Metallurgy 2D S2 L2T2
Prerequisite: 4.432.

4.444 Advanced Crystallography of Phase Transformations S1 or S2 L1
Co- or prerequisite: 4.414.

4.453 Physical Metallurgy 2E S2 L1T1½
Prerequisite: 4.432.

4.494 High Temperature Techniques S1 or S2 L1
Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures.

4.613A Metallurgical Engineering 2A S1 L2T1
Prerequisite: 4.722.

4.614 Metallurgical Engineering 3A S1 L1T1
Prerequisite: 4.613A.

4.623B Metallurgical Engineering 2B S2 L3T½
Prerequisite: 2.102A.

4.624B Metallurgical Engineering 3B S1 L3
Prerequisite: 4.732.

4.633 Metallurgical Engineering 2C F L2T1½
Prerequisites: 10.001 or 10.011.

4.634 Metallurgical Engineering 3C S1 L2T½
Prerequisite: 4.453.

4.642 Metallurgical Engineering 1D S2 L1T1
Prerequisite: 4.732.
Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Processes of forging, roll-
ing, extrusion, and wire drawing. Die materials and geometry. Deformation parameters and processing defects.

4.643 Metallurgical Engineering 2D S2 L2T1
Prerequisites: 4.412A, 4.732.

4.644 Metallurgical Engineering 3D S2 L2T2
Prerequisite: 4.453.

4.654 Metallurgical Engineering 3E S2 L1T3
Prerequisites: 4.633, 4.643.
Engineering design. Engineering design codes of practice, experimental and theoretical stress analysis and fracture mechanics. Design codes and statutory regulations with emphasis on selection of materials for service conditions. Design approaches to fatigue and brittle fracture are treated in terms of contemporary rules for approaches to fatigue and dynamic loading and low temperature service. Stress analysis component is presented in terms of both experimental techniques and numerical analysis using finite element computer programs. Emphasis in laboratory coursework is on electrical resistance strain gauge techniques but other techniques are also applied. Quantitative design against fracture in terms of linear elastic fracture mechanics and elastic plastic fracture mechanics using COD and J integral approaches is presented with reference to case studies.

4.664 Surface Treatments and Wear S2 L1T1
Prerequisite: 4.623B.

4.674 Mathematical Plasticity S2 L1
Prerequisite: 4.633.
Mathematical approaches to macroscopic plastic deformation; slip line field analysis, upper and lower bound techniques, finite element techniques. Application to estimation of loads and stresses developed during industrial deformation processes: rolling, drawing, bending.

4.684 Transport Phenomena in Metallurgical Processes S1 or S2 L1
Co- or prerequisite: 4.614.
Control of many metallurgical processes and design of suitable plant depend on an appreciation of factors affecting rate of reaction. In many cases, especially when conditions are far from equilibrium, transport of heat and/or mass is rate limiting. Deals with application of transport processes (fluidised flow, heat and mass transfer) to a number of typical processes. Illustration from: iron-making, steelmaking, combustion, fluidized bed processing, leaching, solvent extraction, vacuum processing.

4.704 Design With Brittle Materials S1 or S2 L1T½ T1½
Prerequisites 4.732 or 8.6110

4.712 Materials Engineering 1A S1 L1T2½

4.713 X-Ray Diffraction and Electron Microscopy S1 L2T2
Prerequisite: 4.412A or 4.212.

4.722 Materials Engineering 1B S2 L1T2½
Prerequisite: 4.712.
Heat applications of principles of steady and unsteady state heat transfer to primary and secondary metallurgical practice. Course examples are drawn from metallurgical engineering practice in broadest sense: Heat treatment of metals. Water-side corrosion in heat exchangers. Continuous casting. aluminium smelting, electrodes refining, liquid metal-cooled nuclear

4.732 Mechanical Properties of Materials  
Prerequisite: 5.0011. Co-requisite: 4.412A.


4.742 Physics of Materials  
Pre-requisite: 1.001 or 1.011.

Interatomic bonding in solid materials. Types of interatomic bonds, metallic, covalent, ionic. Introductory quantum mechanics in one dimension, free electron theory, effects of periodic potential, density of states curves. Effect of electron to atom ratio on conductivity and crystal structure; semiconductors; intrinsic, extrinsic. Exchange energy; ferromagnetism, antiferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, crystal structures, force models, properties.

4.752 Thermodynamics of Materials 1  
Prerequisite: 2.102A


4.753 Thermodynamics of Materials 2  
Prerequisite: 4.752


4.694 Air Pollution control in the Metallurgical Industry  
Case studies of emission survey, measurements and compliance program planning in the primary and secondary metallurgical industries.
Graduate Study

For Information Key refer to page 7.

4.201G Graduate Materials Seminar  F L1T1
Instruction in written or oral presentation of technical and scientific material at an advanced level which involves a presentation by the candidate of a lecture on a selected topic.

4.211G Metallurgical Practice  S1 or S2
Studies relating to one or more specialised areas such as founding, welding, corrosion.

4.221G Advanced Metallurgical Techniques  S1 or S2
Lectures and laboratory work in such areas as metallography, electron microscopy, stress analysis, fracture mechanics, mechanical testing and electrochemical techniques.

4.231G Advanced Theoretical Metallurgy  S1 or S2
Topics drawn from physical, chemical and mechanical metallurgy.

4.241G Graduate Materials Project  F6
An experimental, technical investigation or design project, including a written thesis.

4.251G Advanced Materials Technology  S1 or S2
Principles of materials selection, selection of materials based on engineering design criteria, materials, specifications and principles and methods of non-destructive testing.
School of Mines
School of Mines

Head of School
Professor G. Hocking

Executive Assistant to Head of School
Dr. C. R. Ward

Administrative Assistant
Miss L. A. Bruce

The School of Mines, which was formed in 1986, consists of three Departments corresponding to the three main professions on which the mining and minerals industry of Australia depends. These are the Departments of Applied Geology; Mining Engineering; Mineral Processing and Extractive Metallurgy.

Prior to the formation of the School of Mines, Applied Geology and Mining Engineering were separate Schools and Mineral Processing and Extractive Metallurgy (sometimes referred to as Mineral Engineering) was spread among several other Schools in the Faculty. Bringing the three together into the School of Mines is an important development in mining industry education in Australia.

Geologists, Mining Engineers and Mineral Engineers work closely together in the mining industry. The Geologist is responsible for discovering new mineral resources and for defining the size, value and condition of the deposit. The Mining Engineer decides if the deposit is worth mining, designs the mine and thereafter manages it throughout its life. The Mineral Engineer deals with these resources after they have been mined, and designs and manages the large plants needed to turn the crude ore into metal or the raw coal into saleable fuel.

Each is an expert in her or his own field, but each also needs to have a good appreciation of the work of the other two. Professional roles in the mining industry are not always clear cut and it is a distinct advantage for geologists, mining engineers and mineral engineers to study and interact together while at University, in preparation for their necessarily close involvement with each other during their professional careers.

Separate degree courses are available in each of the Departments as described below. Students enrol in the course of their own choice and many activities are departmentally centred, but others are School-based to provide a corporate identity with the mining and allied industries.

Department of Applied Geology

Head of Department
Professor J. Roberts

Administrative Officer
Miss L. A. Bruce

Geology is 'the science of the earth', and as such covers a broad spectrum of knowledge on the constitution and evolution of our planet. Applied geology involves a specific interest in the use of earth science for the benefit of humanity, including, for example, the search for and evaluation of metallic ore-bodies and accumulations of fossil fuels, or the application of geological knowledge to a range of engineering and environmental problems.

Department of Mineral Processing and Extractive Metallurgy

Head of Department
Associate Professor R.G. Robins

Mineral Engineering comprises those professional activities required for the extraction of valuable components from mined
ore, and their conversion into refined metals and similar products used in the manufacturing industries. Graduates from the Mineral Engineering degree course are capable of the professional activities of research and development, design and commissioning of processes and plants, and operation and supervision of production plants in the mineral industry.

The mineral industry is diverse in scope, scale and location. It produces refined metals, construction materials, coal and coke, and a wide variety of other products such as chemicals, ceramics, abrasives and paints. Every mineral deposit has some unique characteristics that influence the extraction processes. Also each deposit is limited in quantity, consequently new ones must be continually investigated and developed. There is, therefore, a progressive challenge to mineral engineers to improve extraction methods and develop new techniques.

New South Wales coal mining comes under the Coal Mines Regulation Act No. 67, 1982, and for metalliferous mining under the Mines Inspection Act No. 75, 1901, as amended.

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.

General Education Electives
For details of changes in the General Education requirements refer to the table earlier in this section.

Staff

School of Mines

Professor of Engineering, Geology and Head of School of Mines
Grant Hocking B.Tech. C.E. S.A.I.T. MSc N’cle(U.K.), PhD D.I.C Lond., FGS, MAIME, MSRM
Executive Assistant to Head of School
Dr. C. R. Ward
Administrative Assistant
Miss L. A. Bruce

Department of Applied Geology

Professor and Head of Department
John Roberts, BSc N.E., PhD W. Aust.
Professor of Geology
Gerald James Spurgeon Govett, DSc Wales, PhD D.I.C Lond., CEng, FIMM
Professor of Engineering Geology
Grant Hocking, B.Tech. C.E. S.A.I.T., MSc N’cle(U.K.), PhD D.I.C Lond., FGS, MAIME, MSRM
Associate Professor
Philip Richard Evans, BA Oxf., PhD Brist., MAIG

Senior Lecturers
Alberto Albani, DrGeoSc Florence, MSc PhD N.S.W.
Chin Yoon Chork, BSc Car., PhD New Br., CEng, MIMM
Alistair Chisholm Dunlop, BSc N.E., PhD Lond., DIC, MIMM
Bastiaan Jan Hensen, MSc Ley., PhD A.N.U.
Michael Barry Katz, BS Mich.T.U., MSc MoG., PhD Tor.
Michael John Knight, BSc PhD MET.
Greg McNally, BSc Syd., BA N.E., MAppSc N.S.W.
Noel Merrick, BSc MSc Syd., DipDP N.S.W.I.T.
William Alexander Mine-Horne, BSc Leic., MSc Lond., PhD Alta., FGS
Gerrit Neff, BSc Lond. PhD Well., FGS
Iftikhar Rasul Qureshi, MSc Pari., PhD Glas, FGS
Peter Cyril Rickwood, BSc Lond., PhD Cape T., CChem, MIRC
Geoffrey Robert Taylor, MSc Birm., PhD N.E., FGS, MIMM, MAusIMM
Colin Rex Ward, BSc PhD N.S.W. MAusIMM, MAIG
Robert James Whitely, MSc Syd., PhD N.S.W.
Lecturer
Paul Gordon Lennox, BSc Tas., PhD Monash
Tutor
Malcolm David Buck, MSc Waik.
Honorary Associates
Frederick Charles Loughnan, BSc Sdyt., PhD DSc N.S.W.
Stephen Scott Webster, MSc Sdyt., MSEG, MASEG, MEAEG
Administrative Assistant
Lynne Anne Bruce
Project Scientist
Frederick Ivor Roberts, BSc N.S.W., PhD W'gong., AMAusIMM
Professional Officers
Zaynab Fidahsayn Muhammad Aly, MSc Lond.
Peter Richard Atherden, BSc N.S.W., MSc Macq.
Mark Francis Reddy, BSc N.S.W.

Department of Mineral Processing and Extractive Metallurgy
Associate Professor and Head of Department
Robert George Robins, MSc PhD N.S.W., MAmerIChE, ARACI, AMAusIMM
Professor of Chemical and Extractive Metallurgy
Vacant
Associate Professor
Alan Philip Prosser, BSc PhD DIC Lond., ARCS, ARACI, AMAusIMM
Senior Lecturer
David Ronald Young, BSc(Eng) PhD Lond., ARSM, AMAusIMM
Lecturers
Peter Nigel Holtham, BSc Leeds, MSc Manc. AMAusIImm
Tam Tran, BSc PhD N.S.W., MAmerIChE, ARACI, MAIME
Honorary Associate
Bernhard John Frederick Ralph, BSc Tas., PhD Liv., FRACI, FFTS

Department of Mining Engineering
Professor and Head of Department of Mining Engineering
Frank Ferdinand Roxborough, BSc PhD Durh., CEng, FIE Aust, FI MinE, FIMM, MAusIMM
Professor of Mining Engineering
Leon John Thomas, BSc PhD Birm., CEng, FIEAust, FI MinE, MAusIImm
Associate Professor
Edward George Thomas, BE PhD OId., MAusIMM, MAIME MCIMM
Senior Lecturers
Amal Krishna Bhattacharyya, BSc Glas., MSc Durh., PhD N'cle(U.K.), CEng, PEng, MI MinE, MCIMM, MAIME, MAusIImm

Gour Chand Sen, MSc Wales, PhD Durh CEng, FI ExpE, FI MinE, MAusIMM
Venkata Satyanarayana Vutukuri, BSc(Eng) Ban., MS Wls., MMGI, AIME, AMAusIMM
John Ormiston Watson BSc(Eng) Nottn. PhD S'hampton

Lecturers
Christopher Raymond Daly, BE MSc(Acoustics) N.S.W., AIME.
Drago Panich, BE N.S.W., MSc N'cle(U.K.)

Professional Officers
Paul Carter Hagan, BE N.S.W.
Joseph Arthur Shonhardt, BSc(Tech) MSc N.S.W., AIM, AMAusIMM

Centre for Groundwater Management and Hydrogeology
(in association with the Faculty of Engineering)
Director
Michael John Knight, BSc PhD Melb., FGS, MIE Aust
Deputy Director
Colin Raymond Dudgeon, BE ME PhD N.S.W.
Senior Staff Member
Keith Kingsford Watson, BE ME PhD N.S.W., DSc, FIE Aust
Senior Lecturers
William Alexander Mine-Home, BSc Leic., MSc Lond., PhD Alta., FGS
Richard Ian Acworth, BSc Leeds, MSc PhD Birm., FGS
Professional Officers
Robert Gregor McLaughlan, BSc Grad Dip MAppSc N.S.W.
Anna Eade, BSc N.S.W. DipComProg
Administrative Assistant
Beverley Ann Colin

Centre for Waste Management
(in association with the Faculty of Engineering)
Director
Vacant
Deputy Director
Michael John Knight, BSc PhD Melb., FGS, MIE Aust
Lecturer
Eric Matthewi Claus, BSc Loyola Marymount, MSc Utah State, MIE Aust

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Course Outlines

Undergraduate Study

Department of Applied Geology

The degree course in Applied Geology is of four years' duration and leads to a BSc degree at Pass or Honours level. It provides a comprehensive education in all aspects of earth science, with emphasis on the skills and applications required for professional practice of geology in the mineral industry, construction and development, or related areas. Graduates are prepared by the course to enter any branch of the geological profession, and to change their area of employment as different opportunities arise.

No previous knowledge of geology is required to enter this course but a sound background in mathematics together with one or more other science subjects is essential. Students will take programs designed to bring them up to a satisfactory standard of physics and chemistry in year 1. Students who have reached a satisfactory standard in HSC geology may be offered an alternative program in Year 1.

A three-year full-time course in Geology, and courses that combine a single major in Geology with Physics, Chemistry, Mathematics, or Botany and Zoology, and courses that combine Geology with Geophysics and Geography are available to students in the Faculty of Science. Provision is also made for part-time study in the first year of Geology within that Faculty. Selected students in the Faculty of Science may study 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 a full-time basis. The courses are designed to provide specialized training in practical applications to these fields.

General Education Electives

For details of changes in the General Education requirements refer to the table earlier in this chapter.

3000

Applied Geology — Full-time

Bachelor of Science

BSc

Year 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>1.001</td>
<td>Physics 1</td>
<td>6</td>
</tr>
<tr>
<td>1.021</td>
<td>Introductory Physics</td>
<td>6</td>
</tr>
<tr>
<td>2.121</td>
<td>Chemistry 1A*</td>
<td>6</td>
</tr>
<tr>
<td>2.131</td>
<td>Chemistry 1B</td>
<td>6</td>
</tr>
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<td>Mathematics 1 or 2 or 3</td>
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<td>10.011</td>
<td>Higher Mathematics or 1B and 1C</td>
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<tr>
<td>25.110</td>
<td>Earth Materials and Processes*</td>
<td>6</td>
</tr>
<tr>
<td>25.120</td>
<td>Earth Environments and Dynamics**</td>
<td>6</td>
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</tbody>
</table>

*Students without the specified prerequisite for 2.121 will be required to take either a Chemistry Bridging Course or 2.111, Introductory Chemistry before enrolling in this subject.

**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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.211</td>
<td>Earth Materials 1**</td>
<td>6</td>
</tr>
<tr>
<td>25.212</td>
<td>Earth Environments 1**</td>
<td>6</td>
</tr>
<tr>
<td>25.221</td>
<td>Earth Materials 2***</td>
<td>6</td>
</tr>
<tr>
<td>25.223</td>
<td>Earth Physics*</td>
<td>6</td>
</tr>
<tr>
<td>25.2261</td>
<td>Mathematical Geology 1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>General Education Elective</td>
<td>2</td>
</tr>
</tbody>
</table>

*Field work of up to 2 days is a compulsory part of the subject.

**Field work of up to 5 days is a compulsory part of the subject.

***Field work of up to 4 days is a compulsory part of the subject.

Students take Ancillary Subjects equivalent to 2 units from Table 1 of the Combined Sciences Handbook.

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Course Title</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>25.311</td>
<td>Earth Materials 3</td>
<td>6</td>
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<tr>
<td>25.312</td>
<td>Earth Materials 4*</td>
<td>0</td>
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<tr>
<td>25.312</td>
<td>Earth Environments 2**</td>
<td>6</td>
</tr>
<tr>
<td>25.333</td>
<td>Exploration Geophysics</td>
<td>3</td>
</tr>
<tr>
<td>25.3162</td>
<td>Mathematical Geology 2</td>
<td>3</td>
</tr>
<tr>
<td>25.314</td>
<td>Mineral and Energy Resources 1***</td>
<td>6</td>
</tr>
<tr>
<td>25.324</td>
<td>Mineral and Energy Resources 2*</td>
<td>0</td>
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<tr>
<td>25.325</td>
<td>Engineering and Environmental Geology***</td>
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<tr>
<td>25.3261</td>
<td>Geochemical Analytical Techniques</td>
<td>2</td>
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<tr>
<td>25.3271</td>
<td>Structural Geology*</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>Year 4</th>
<th>Course Title</th>
<th>Hours per week</th>
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<tr>
<td>25.410</td>
<td>Resource Geology*</td>
<td>A</td>
</tr>
<tr>
<td>25.420</td>
<td>Field Project</td>
<td>12</td>
</tr>
<tr>
<td>25.4101</td>
<td>Topics in Advanced Geology</td>
<td>24</td>
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</table>

*Field work of up to 4 days is a compulsory part of the subject.

**Field work of up to 7 days is a compulsory part of the subject.

***Field work of up to 3 days is a compulsory part of the subject.
and either

A. Mineral Resources strand, consisting of

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>7.013 Principles of Mining</td>
<td>2 A 2 B</td>
</tr>
<tr>
<td>7.044 Mining Economics</td>
<td>4 A 4 B</td>
</tr>
<tr>
<td>25.4141 Mineral Exploration</td>
<td>5</td>
</tr>
<tr>
<td>25.4142 Geological Sampling and Analytical Methods**</td>
<td>4</td>
</tr>
<tr>
<td>25.4143 Research Project</td>
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</tr>
<tr>
<td>Total</td>
<td>11 A 15 B</td>
</tr>
</tbody>
</table>

or

B. Sedimentary Basin Resources strand, consisting of

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td>25.4121 Advanced Sedimentology</td>
<td>A 7 B 7</td>
</tr>
<tr>
<td>25.4122 Seismic Stratigraphy and Log Analysis</td>
<td>4</td>
</tr>
<tr>
<td>25.4123 Geology of Selected Oil and Gas or Coal Fields</td>
<td>4</td>
</tr>
<tr>
<td>25.4124 Palynology or Foraminiferal Micropalaeontology</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>11 A 15 B</td>
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</table>

or

C. Engineering and Environmental Geology strand, consisting of

<table>
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<tr>
<th>Course Description</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>25.4151 Hydrogeology</td>
<td>A 3 B 3</td>
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<tr>
<td>25.4152 Engineering Geology</td>
<td>3 A 3 B</td>
</tr>
<tr>
<td>25.4153 Environmental Geology</td>
<td>3 A 3 B</td>
</tr>
<tr>
<td>25.4154 Engineering Geology Project</td>
<td>2 A 6 B</td>
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<tr>
<td>Total</td>
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</table>

or

D. Geophysics strand**, consisting of

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td>25.4122 Seismic Stratigraphy and Log Analysis</td>
<td>A 4</td>
</tr>
<tr>
<td>25.9311 Gravity and Magnetic Methods</td>
<td>3 A 3 B</td>
</tr>
<tr>
<td>25.9312 Seismic Methods</td>
<td>3 A 3 B</td>
</tr>
<tr>
<td>25.9313 Electrical Methods</td>
<td>3 A 3 B</td>
</tr>
<tr>
<td>25.9315 Regional Geophysics</td>
<td>2</td>
</tr>
<tr>
<td>and either</td>
<td></td>
</tr>
<tr>
<td>25.4141 Mineral Exploration</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>25.4123 Geology of Selected Oil and Gas or Coal Fields</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>13/14 15</td>
</tr>
</tbody>
</table>

$Session 1 is divided into 2 segments of 7 weeks each. Hours listed under A apply to weeks 1-7; those under B apply to weeks 8-14.

* Field work of up to 7 days is a compulsory part of this subject.

** Field work of up to 3 days is a compulsory part of the subject of the strand.
Department of Mineral Processing and Extractive Metallurgy

The Department offers an undergraduate course of four years duration leading to the award of a BE degree at pass or honour level. This course meets the formal requirements for admission to the professional mining and metallurgical institutions.

A double degree in Chemical Engineering and Mineral Engineering, Bachelor of Engineering/Bachelor of Science degree is available. Students may be awarded honours BE/BSc double degree for distinguished performance over five years of study. Refer to School of Chemical Engineering.

The Mineral Engineering course is based on a broad spectrum of mathematics, physics, chemistry, geology, mineralogy and chemical engineering, and specializes in mineral processing, extractive metallurgy and process plant design.

A Master of Applied Science degree course in Mineral Engineering is also offered.

3126

Mineral Engineering — Full-time Course

Bachelor of Engineering
BE

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
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</thead>
<tbody>
<tr>
<td>1.001</td>
<td>Physics 1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2.121</td>
<td>Chemistry 1A and</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2.131</td>
<td>Chemistry 1B</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>5.0011</td>
<td>Engineering Mechanics 1</td>
<td>4</td>
<td>0</td>
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<tr>
<td>5.0012</td>
<td>Introduction to Engineering Design and Materials</td>
<td>2</td>
<td>0</td>
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<tr>
<td>5.0302</td>
<td>Engineering Drawing and Descriptive Geometry</td>
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<td>4</td>
</tr>
<tr>
<td>7.610</td>
<td>Introduction to Mining and Mineral Engineering</td>
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<td>2</td>
</tr>
<tr>
<td>10.011</td>
<td>Higher Mathematics 1 or Mathematics 1</td>
<td>6</td>
<td>6</td>
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<td>24</td>
<td>24</td>
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<table>
<thead>
<tr>
<th>Year 2</th>
<th>Hours per week</th>
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<th>S2</th>
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<tbody>
<tr>
<td>2.102A</td>
<td>Physical Chemistry</td>
<td>6</td>
<td>0</td>
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<tr>
<td>7.621</td>
<td>Mineral Engineering Science 1</td>
<td>0</td>
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<tr>
<td>7.622</td>
<td>Mineral Engineering 1</td>
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<td>3</td>
</tr>
<tr>
<td>7.623</td>
<td>Mineral Engineering Laboratory 1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.031</td>
<td>Mathematics</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>10.301</td>
<td>Statistics SA</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>25.520</td>
<td>Geology for Mining Engineers 1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

3129

Chemical Engineering/Mineral Engineering — Full-time Course

Bachelor of Engineering/Bachelor of Science BE/BSc

Refer to School of Chemical Engineering and Industrial Chemistry section.
The Department offers a 4 year full-time course in Mining Engineering leading to the award of the degree of Bachelor of Engineering at Pass or Honours level, 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 Mineral Engineering.

3140
Mining Engineering — Full-time Course

Bachelor of Engineering
BE

Year 1 of the course is similar to all that for several other Engineering courses and Year 2 includes those subjects of common relevance to the Engineering disciplines. Year 3 is largely devoted to basic mining subjects and Year 4 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 metallic iron mining. An important fourth year requirement is for students to undertake personal research or a 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

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
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</thead>
<tbody>
<tr>
<td>1.001</td>
<td>6 6</td>
</tr>
<tr>
<td>2.951</td>
<td>6 0</td>
</tr>
<tr>
<td>5.001</td>
<td>4 0</td>
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<tr>
<td>5.0721</td>
<td>0 3</td>
</tr>
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<td>7.011</td>
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<td>7.031</td>
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<tr>
<td>7.041</td>
<td>0 3</td>
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<tr>
<td>10.001</td>
<td>6 6</td>
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Year 2

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.9222 Electronics</td>
<td>3 0</td>
</tr>
<tr>
<td>4.942 Materials for Mining Engineers</td>
<td>3 3</td>
</tr>
<tr>
<td>6.854 Electrical Power Engineering</td>
<td>0 3</td>
</tr>
<tr>
<td>7.012 Stress Analysis in Mining 2</td>
<td>3 0</td>
</tr>
<tr>
<td>7.132 Fluid Mechanics and Thermodynamics</td>
<td>2 2</td>
</tr>
<tr>
<td>7.142 Mine Development*</td>
<td>2 0</td>
</tr>
<tr>
<td>7.172 Microcomputers (Mining)</td>
<td>2 0</td>
</tr>
<tr>
<td>10.022 Engineering Mathematics 2</td>
<td>4 4</td>
</tr>
<tr>
<td>10.301 Statistics SA</td>
<td>2 2</td>
</tr>
<tr>
<td>25.520 Geology for Mining Engineers*</td>
<td>2 2</td>
</tr>
<tr>
<td>29.441 Surveying for Engineers</td>
<td>0 6</td>
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<tr>
<td>29.491 Survey Camp</td>
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General Education Subject 2 2

Year 3

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<th>Subject</th>
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<tbody>
<tr>
<td>7.113 Mining Methods</td>
<td>2 2</td>
</tr>
<tr>
<td>7.1231 Geomechanics A</td>
<td>3 0</td>
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<tr>
<td>7.1232 Geomechanics B</td>
<td>0 2</td>
</tr>
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<td>7.133 Mine Transport</td>
<td>0 3</td>
</tr>
<tr>
<td>7.153 Power Supply in Mines</td>
<td>2 0</td>
</tr>
<tr>
<td>7.163 Excavation Engineering</td>
<td>2 2</td>
</tr>
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<td>7.173 Computer Applications in Mining</td>
<td>1 1</td>
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<tr>
<td>7.183 Mine Ventilation and Drainage</td>
<td>2 2</td>
</tr>
<tr>
<td>7.213 Mine Surveying</td>
<td>2 0</td>
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<tr>
<td>7.223 Mine Feasibility Studies</td>
<td>0 1</td>
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<tr>
<td>7.433 Mining Laboratory</td>
<td>2 2</td>
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<tr>
<td>7.7342 Minerals Engineering Processes</td>
<td>3 3</td>
</tr>
<tr>
<td>25.530 Geology for Mining Engineers 2*</td>
<td>4 4</td>
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</table>

General Education Subject 2 2

Year 4

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<th>Subject</th>
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<tbody>
<tr>
<td>7.114 Geotechnical Engineering</td>
<td>2 2</td>
</tr>
<tr>
<td>7.174 Mining Legislation</td>
<td>0 2</td>
</tr>
<tr>
<td>7.214 Mine Economics and Planning</td>
<td>4 2</td>
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<tr>
<td>7.224 Operational Management</td>
<td>2 2</td>
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<td>7.304 Mine Safety Engineering</td>
<td>2 2</td>
</tr>
<tr>
<td>7.414 Minerals Industry Project</td>
<td>5 5</td>
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<tr>
<td>7.424 Industrial and Research Seminars</td>
<td>1 1</td>
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</table>

General Education Subject 2 2

Together with an approved group of three advanced subjects selected from the following

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>7.104 Underground Coal Mining*</td>
<td>2 2</td>
</tr>
<tr>
<td>7.144 Surface and Offshore Mining</td>
<td>2 2</td>
</tr>
<tr>
<td>7.184 Underground Metalliferous Mining*</td>
<td>2 2</td>
</tr>
<tr>
<td>7.194 Tunnel Engineering and Shaft Sinking</td>
<td>2 2</td>
</tr>
<tr>
<td>7.744 Mineral Process Technology</td>
<td>2 2</td>
</tr>
</tbody>
</table>

†Approval for a group of subjects must be obtained from the Head of School and must include at least one of the subjects marked*. An elective subject of special interest to a particular student but not on the above list may be taken, with the approval of the Head of Department.

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

Department 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 25.702G Hydrogeology, 25.704G Environmental Geology, or 25.708G Engineering Geology.

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.

Unit A (Weeks 1-7 Session 1)

25.800G Seminar
25.801G Geology in Exploration 1
25.802G General Introduction to Exploration Geophysics
25.803G Introduction to Exploration Geochemistry
28.804G Introduction to Data Processing and Interpretation
25.805G Resource Economics 1
and either
25.807G Exploration Geophysics
or
25.808G Exploration Project
or
7.013 Principles of Mining
and
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 2
25.816G Remote Sensing
25.817G Mining Law and Exploration Management
25.840G Seminar
7.001G Exploration Drilling
and either
7.013* Principles of Mining
and
7.044* Mining Economics
or
25.818G Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session 2)

25.819G Field — Laboratory Project

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.

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 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 Department to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)
25.800G Seminar
25.801G Geology in Exploration 1
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 1
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 applications, 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 Department to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)
25.800G Seminar
25.801G Geology in Exploration 1

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 1 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)
25.831G Geological Interpretation
25.832G Advanced Exploration Geophysics
25.840G Seminar

Unit C (Session 2)
25.829G Field — Laboratory Project

Refer to Graduate Study section in the School of Geography for the following graduate courses:
5025 Graduate Diploma in Arid Land Management
8025 Master of Applied Science in Arid Land Management
  • Hydrogeology
  • Terrain Management
5026 Graduate Diploma in Remote Sensing
8026 Master of Applied Science in Remote Sensing
8045 Master of Environmental Studies

Centre for Groundwater Management and Hydrogeology

The Centre for Groundwater Management and Hydrogeology was established in 1987 as a Federal National Centre. It is a joint enterprise of the faculties of Applied Science and Engineering with general aims to research groundwater problems of strategic national importance and to co-ordinate and develop postgraduate courses, continuing education programs and to liaise with industry. An M AppSc degree in Hydrogeology and Groundwater Management is planned for implementation in 1989.

8021 Hydrogeology and Groundwater Management Graduate Course
Master of Applied Science MAppSc
Applied Science

Core Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Session</th>
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<tr>
<td>25.702G</td>
<td>Hydrogeology</td>
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<tr>
<td>8.880G</td>
<td>Groundwater Modelling</td>
<td>3</td>
<td>1</td>
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<tr>
<td>7.937G</td>
<td>Hydrogeochemistry</td>
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<tr>
<td>8.875G</td>
<td>Hydrological Processes</td>
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Co-requisite Subject (as required for 25.721G and 7.937G) (satisfactory level required to be achieved)

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>25.717G</td>
<td>Computing for Groundwater</td>
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Options

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<tbody>
<tr>
<td>25.707G</td>
<td>Geopollution Management</td>
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<tr>
<td>25.716G</td>
<td>Groundwater Geophysics</td>
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<tr>
<td>25.718G</td>
<td>Remote Sensing of</td>
<td></td>
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<tr>
<td></td>
<td>Groundwater Resources</td>
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<tr>
<td>8.843G</td>
<td>Groundwater Hydraulics</td>
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<tr>
<td>8.847G</td>
<td>Water Resources Policy*</td>
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<tr>
<td>8.849G</td>
<td>Irrigation*</td>
<td></td>
<td></td>
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<tr>
<td>8.850G</td>
<td>Drainage of Agricultural land*</td>
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Project

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<th>Course Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Session</th>
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<tbody>
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<td>25.719G</td>
<td>Groundwater Research Project</td>
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<td>25.720G</td>
<td>Groundwater Project (C12)</td>
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Elective Subjects

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<th>Credits</th>
<th>Session</th>
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<tr>
<td>7.152G</td>
<td>Mining Conservation</td>
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<td></td>
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<tr>
<td>7.535X</td>
<td>Mine Fill Technology</td>
<td></td>
<td></td>
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<tr>
<td>48.391G(X)</td>
<td>Atmospheric Pollution Control</td>
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<tr>
<td></td>
<td>(Theory)</td>
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<tr>
<td>48.392G(X)</td>
<td>Atmospheric Pollution Control</td>
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<td></td>
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<tr>
<td></td>
<td>(Practical Aspects)</td>
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<tr>
<td>8.857G</td>
<td>Sewage Treatment and Disposal</td>
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<tr>
<td>8.870G</td>
<td>Hydraulics and Design of Water and Wastewater Treatment Plants</td>
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</table>

5070 Waste Management Graduate Diploma Course

Graduate Diploma GradDip

Candidates are required to complete a course totalling at least 30 credits made up of compulsory subjects, elective subjects and a 3 credit report. The diploma may be obtained full-time (normally 2 sessions of 15 credits) or part-time (4 sessions) basis. An external course program is also offered (normally over 4 sessions).

Selection of subjects for formal course work must be approved by the Director. A candidate must normally complete 18 credits of core subjects.

Core Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>8.872G</td>
<td>Management of Wastes</td>
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<tr>
<td>8.873G</td>
<td>Waste and Wastewater Analysis</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>and Environmental Requirements</td>
<td></td>
<td></td>
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<tr>
<td>8.874G</td>
<td>Waste Management Science</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

Elective Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Session</th>
</tr>
</thead>
<tbody>
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<tr>
<td>7.535X</td>
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<td></td>
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<tr>
<td>48.391G(X)</td>
<td>Atmospheric Pollution Control</td>
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<td></td>
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<tr>
<td></td>
<td>(Theory)</td>
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</tbody>
</table>
Department of Mineral Processing and Extractive Metallurgy

8055
Mineral Engineering Graduate Course
Master of Applied Science MAppSc

The course is under revision and will not be offered until 1990.

Department of Mining Engineering

8056
Mining Geomechanics Graduate Course — Part-time (External)
Master of Applied Science MAppSc

The course is offered to enable graduate mining engineers, geologists and civil engineers stationed in remote locations to carry out advanced theoretical and practical studies in geomechanics applicable to mining operations. Most of the work is completed by correspondence, with the exception of short annual residential schools of two weeks duration at the Kensington campus.

Enquiries from graduates living in the Sydney metropolitan area, as well as from graduates in other disciplines, are welcomed. In the latter case it may be necessary to include supporting subjects at undergraduate level within the Masters' program as approved by the Head of Department, up to a maximum of 25 per cent of the total program. It may also be necessary in some circumstances to take some prerequisite or co-requisite back ground undergraduate subjects, as directed by the Head of Department.

The program consists of formal study equivalent to nine to ten hours of lectures per week, depending on the subjects chosen, for two years on a part-time external basis. Not less than 20 per cent of the total program consists of a project on an approved topic covering a field or laboratory investigation of a mining geomechanics problem.

Three of the subjects, in addition to the project, form a compulsory core strand. These are augmented by a range of elective, optional subjects. A grouping of five options (including selections from undergraduate subjects, where appropriate) may be selected for study, subject to the approval of the Head of School and availability of the topics.

Assessment is by formal examination (at appropriate country centres where necessary) and by assignment work.

<table>
<thead>
<tr>
<th>Core Subjects</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.515X Rock Mechanics</td>
<td>S1 3, S2 3</td>
</tr>
<tr>
<td>7.525X Strata Control Engineering</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>8.776G Rock Mechanics</td>
<td>S1 0, S2 3</td>
</tr>
<tr>
<td>Project</td>
<td>S1 4, S2 4</td>
</tr>
</tbody>
</table>

Optional Subjects

Group A

<table>
<thead>
<tr>
<th></th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.535X Mine Fill Technology</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.545X Advanced Rock Cutting Technology</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.555X Blasting Technology</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.565X Rock Slope Stability</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.575X Subsidence Engineering</td>
<td>S1 2, S2 2</td>
</tr>
<tr>
<td>7.585X Economics and Management of Geomechanics Projects</td>
<td>S1 2, S2 2</td>
</tr>
</tbody>
</table>

Group B

<table>
<thead>
<tr>
<th></th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.777G Numerical Methods in Geomechanics</td>
<td>S1 0, S2 3</td>
</tr>
<tr>
<td>25.702G Hydrogeology</td>
<td>S1 0, S2 3</td>
</tr>
<tr>
<td>25.706G Geological Basis of Geomechanics</td>
<td>S1 3, S2 0</td>
</tr>
<tr>
<td>25.708G Engineering Geology</td>
<td>S1 3, S2 0</td>
</tr>
</tbody>
</table>

The program is arranged as follows:

Year 1

The core subjects are taken, together with any approved combination consisting of either two options from Group A or one
option each from Group A and Group B. In certain cases optional subjects may be replaced by undergraduate subjects up to a total of 25 per cent of the total program, subject to the approval of the Head of Department.

Year 2
The project is carried out in Year 2, together with the remaining options or undergraduate subjects of the approved program. Students may take three options from Group A or two options from Group A and one from Group B or one option from Group A and two Options from Group B.

5040
Mining and Mineral Engineering Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma course in Mining and Mineral 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 Mineral 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.

Core Subjects

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.515X Rock Mechanics Measurements</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.525X Strata Control Engineering</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>8.776G Rock Mechanics</td>
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<td>3</td>
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</table>

Project

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.455X Mining Geomechanics Project</td>
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Optional Subjects

Group A

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.535X Mine Fill Technology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.545X Advanced Rock Cutting Technology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.555X Blasting Technology</td>
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</tr>
<tr>
<td>7.565X Rock Slope Stability</td>
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<td>7.575X Subsidence Engineering</td>
<td>2</td>
<td>2</td>
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<tr>
<td>7.585X Economics and Management of Geomechanics Projects</td>
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Group B

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>S1</th>
<th>S2</th>
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<tbody>
<tr>
<td>8.777G Numerical Methods in Geomechanics</td>
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<tr>
<td>25.702G Hydrogeology</td>
<td>0</td>
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<tr>
<td>25.706G Geological Basis of Geomechanics</td>
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<tr>
<td>25.708G Engineering Geology</td>
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</table>
Subject Descriptions

Undergraduate Study

Departments of Mining Engineering and Mineral Processing and Extractive Metallurgy

Mining Engineering and Mineral Processing and Extractive Metallurgy are Departments within the School of Mines.

7.011 Stress Analysis in Mining 1  S2 L1T2

7.012 Stress Analysis In Mining 2  S1 L1T2
Prerequisite: 7.011

7.013 Principles of Mining  S1 L2

7.021 Mining, Minerals and Environment  S2 L2T1

7.031 Descriptive Engineering  S1 L1T1

7.041 Technical Communication  S2 L1T2

7.044 Mining Economics  S1 L2T2

7.104 Underground Coal Mining  F L1T1
Prerequisites: 7.113, and 7.114, 7.1231, 7.1183.
Effect of surface improvements and structural geology on mine layout. Influence of coal seam properties on choice of extraction height and working section. Coal properties related to machine extraction. Pillar and coface layouts to optimise strata control. Face and roadway support systems. Mechanised extraction: cutting machines, their stability and steering, armoured face conveyors and stage loaders, coal clearance systems, coal bunkerage. Mechanisation problems in thin, thick and faulted seams. Multi-seam layouts. Limitations on face advance rate. Logistics of high-speed extraction - supplies, manpower, rapid transfer of face equipment. Packing and stowing. Hydraulic mining. Supervision and performance criteria.

7.113 Mining Methods  F L2
Prerequisite: 7.142.

7.114 Geotechnical Engineering  F L1T1
Prerequisites: 7.1231, 7.1232.
Stresses around mine openings: magnitude and distribution, determination by analytical methods, analogue and mathematical modelling, in situ measurements. Energy changes caused by excavations. Initiation and propagation of failure in rock struc-

115
7.133 Mine Transport  
S2 L2T1

7.142 Mine Development  
S1 L2
Prerequisite: 7.021.

7.144 Surface and Offshore Mining  
F L1T1
Prerequisite: 7.113.

7.153 Power Supply In Mines  
S1 L1T1
Prerequisite: 1.9222, 6.854, 7.031, 7.132.

7.163 Excavation Engineering  
F L1
7.172 Microcomputers in Mining
Types of microcomputers, components, operating systems. Spread sheets, data bases and word processors. Software applicable to mining. Use of microcomputers for control, monitoring and data acquisition.

7.173 Computer Applications in Mining
Prerequisite: 7.172.
Simulation of mining problems. Application of selected programs to exploration, operations, economics and design.

7.174 Mining Legislation
An appreciation of the laws relating to mining practice and to safety and health in mines.

7.183 Mine Ventilation and Drainage

Mine drainage — engineering hydrology, sources of mine water, forecasting water inflows, drainage and dewatering, pumps and pumping.

7.184 Underground Metalliferous Mining
Prerequisite: 7.113

7.194 Tunnel Engineering and Shaft Sinking
Not available to students who have completed 7.164.

7.213 Mine Surveying
Prerequisite: 29.441.

7.214 Mine Economics and Planning
Prerequisite: 7.113, 7.223
Resource sampling, reserve calculations by traditional methods and by geostatistics, feasibility studies including calculation of capital costs and operating costs, company taxation. Feasibility study project. Project financing — equity, debt, leasing, non-recourse financing, joint ventures. Company types and structures, capitalisation, documents of incorporation and of annual reports. Commodity marketing, metal exchanges, producer pricing, price forecasting. Mining law, mineral ownership, federal and state responsibilities, royalties. Project control, contracts. Insurance. Operating cost systems, discounted cash flow techniques applied to mine expansion and system modification. Replacement of mine plant.

7.223 Mine Feasibility Studies
Elements of mineral project cash flow. Application of numerical discounted cash flow techniques to economic analysis of mineral projects. Parameter sensitivity calculations.

7.224 Operational Management
Approaches to management study: managerial functions, objectives and decision making, organisation concepts, elementary industrial psychology, work measurement and appraisal, industrial relations, communication, negotiations, recruitment, selection and training of personnel. Operations research: control networks, decision analysis, linear programming, queuing theory, simulation, purchasing and stores policy, management accounting and budget controls, reliability engineering, maintenance procedures, personnel and materials management.

7.234 Mineral Economics

7.304 Mine Safety Engineering
Safety precautions against outbursts. Methane drainage. Fires and explosions in coal and metalliferous mines, exploisable dust. Spontaneous combustion. Water hazards in mines and precautions against inundation. Mine rescue and recovery. Noise measure-

7.414 Minerals Industry Project F T5
Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of Department. 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.

7.424 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 Mines. 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.

7.433 Mining Laboratory F T2
Co-requisites: 7.1231, 7.1232.
A program of laboratory experiments for Year 3 students requiring the submission of appropriate laboratory reports related to the syllabus areas of the co-requisite subjects.

7.610 Introduction to Mining and Mineral Engineering S1 L2
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. The unit operations of mineral processing and extractive metallurgy, related to end use of product and its market value. Safe disposal of waste material.

7.621 Mineral Engineering Science 1 S2 L2T1
Application of the principles of stoichiometry and thermodynamics to mineral processing and extractive metallurgy. Review of the laws of thermodynamics, material and energy accounting, the thermodynamic data sources, chemical and phase equilibria in pyrometallurgical systems, computer methods, theory of metal solutions, slags, fused salts and mattes. Application to combustion of fuels, roasting, chlorination, reduction of oxides, smelting of sulphides and refining of metals.

7.622 Mineral Engineering 1 F3
Unit 1 Physical Operations in Mineral Processing
Basic theory and applications to unit design of the physical operations in mineral beneficiation, breakage and comminution, screening, classification, flotation, gravity concentration, minor separation processes and de-watering. Integration of equipment into complete flowsheets, case studies of operating plants to illustrate the factors that influence the flowsheet design.

Unit 2 Process Design for Mineral Extraction
Mineral extraction processes in terms of mechanisms and achievements. Overall extraction schemes. Quantitative analysis and computation in the solution of mineral engineering problems involving fluid flow, heat transfer, statistics, and mineralogy. End uses of minerals, the technical aspects of the market requirements and how these influence mineral processing and extractive metallurgy.

7.623 Mineral Engineering Laboratory 1 S2 T3
Laboratory exercises relevant to both mineral and metallurgical processing covering: experimental design, the gathering and interpretation of data used for the assessment of ores and minerals in order to determine the processes most suitable for their beneficiation and subsequent refinement or utilization.

7.631 Mineral Engineering Science 2 S1 L5
Unit 1 Physical and Chemical Characterisation of Mineral Particles
Physico-chemical and electrical characteristics of surfaces. Surface phenomena in flotation. Fluid particle dynamics and the characteristics of ores and ore pulps in relation to the handling of these materials. Fine particle statistics in mineral beneficiation.

Unit 2 Aqueous Thermodynamics and Hydrometallurgical Processes
Application of principles of aqueous thermodynamics, electrochemistry, chemical and electrochemical kinetics, to hydrometallurgical processes: leaching of minerals and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction.

Unit 3 Elements of Geomechanics
Elements of geomechanics in relation to the classification, testing, handling and disposal of rocks and soils.

7.632 Mineral Engineering 2 F L3
Unit 1 Plant Performance
Plant performance monitoring and the analysis, computation and reporting of operating data. Analysis and evaluation of mineral processing operations and extractive processes.

Unit 2 Process Design 1
Integrated design of mineral processing and extraction circuits. The application of reaction engineering principles to the design and evaluation of mineral and metallurgical reactors and processes with consideration of unsteady state processes. Identification of the information required to select and design processes, dealing with deficiencies in information. Development of communication skills through the collection and presentation of technical information.
7.633 Mineral Engineering Laboratory 2  F T3
Exercises in mineral processing and extractive metallurgy designed to develop investigational skills for: obtaining quantitative relations for process phenomena, testing the performance of a machine or reactor, simulating a process by a computer program. Instrumental analysis, quantitative measurements of the properties of minerals and particles, solutions and gases. Collection and interpretation of data from operating plants. Development of proficiency in technical report writing, and communication.

7.642 Mineral Engineering 3  F L3T3
Unit 1 Control and Simulation
Problems in the automatic control and on-line analysis of mineral and metallurgical processes.

Unit 2 process Design 2
Methodologies and mineral engineering investigations, including statistical design of testwork, development of quantitative empirical relationships, sensitivity analysis, and development of theoretical relationships. Development of a systematic approach to technical decision-making, with industrial case studies.

Unit 3 Environmental Engineering

7.643 Mineral Engineering Projects and Laboratory  S1 T6 S2 T9
One major investigation based on a selected problem in mineral engineering. A second problem in process selection and design based on quantitative data for various options. A third project may be included as an exercise in selection and evaluation of information from the literature for a specific case study. Seminars.

7.714 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.

7.725 Chemical and Extractive Metallurgy 1  S2 L2T1

7.734 Mineral Process Engineering  S1 L2T1

7.7341 Mineral Process Engineering  S1 L2

7.7342 Minerals Engineering Processes  F L1T2

7.735 Chemical and Extractive Metallurgy 2  S1 L2T1½

7.744 Mineral Process Technology  F L1T1
25.110 Earth Materials and Processes S1 L2T4

Stream 1


OR

25.211 Earth Materials 1 S1 L2T4

Prerequisite: 25.120.


25.212 Earth Environments 1 S1 L3T3

Prerequisite: 25.120.

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition: alluvial, nearshore, shelf and deep sea, in both ter-

25.221 Earth Materials 2
Prerequisite: 25.211.

25.223 Earth Physics
Prerequisite: 25.110.

25.2261 Mathematical Geology 1
Prerequisite: 25.120.
Geological Statistics. Measurement scales in geology. Probability distributions and their properties; sampling and test of significance. Application of these techniques using geological data. Geological Computing. FORTRAN programming; text editing; control language for VAX and CYBER.

25.311 Earth Materials 3
Prerequisite: 25.221.

25.312 Earth Environments 2
Prerequisite: 25.212 (note: it is desirable that students taking this unit have also taken 25.223).

25.314 Mineral and Energy Resources 1
Co-requisite: 25.221 or 25.311.
Metallic Resources: Classification and origin of the ore deposits, geochemical processes, research methods. Orthomagnetic, 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. 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 three days is a compulsory part of the subject.

25.3162 Mathematical Geology 2
Prerequisite: 25.2261.
Application of the mathematical techniques listed below to geological data processing and analysis. Analysis of variance. Introduction to matrix algebra. Regression analysis; trend surface analysis; time series analysis; Markov chain analysis. Introduction to nonparametric statistics. Introduction to multivariate statistics. Practical work based on the use of SPSS, BMDP and other library programs.

25.321 Earth Materials 4
Prerequisite: 25.221.
Clay Mineralogy. The structure and properties of the clay min-

25.324 Mineral and Energy Resources 2 S2 L3T3
Prerequisite: 25.212 or 25.5212.

25.325 Engineering and Environmental Geology S2 L4T2

25.3261 Geochemical Analytical Techniques S2 L1T1
Prerequisite: 25.311.

25.3271 Structural Geology S2 L1T1
Prerequisite: 25.212.
Advanced Structural Geology. Analysis of structural elements at the microscopic, mesoscopic and macroscopic scales. Detailed studies of the analysis of metamorphic terrains, eg Cooma Complex, Broken Hill. Field work of up to four days is a compulsory part of the subject.

25.333 Exploration Geophysics S1 L3 and S2 L1T1
Prerequisite: 25.120.
Physical properties of rocks and soils. Introduction to seismic, gravity, magnetic, electrical, electromagnetic 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. Interpretation of geophysical data. Field work of up to three days is a compulsory part of the subject.

25.410 Resource Geology S1 L3T6
25.4101 Topics In Advanced Geology S1 L3
Topics in geology selected from a list of subjects available from the Head of Department.

25.4121 Advanced Sedimentology S1 T6
Detailed field and laboratory study of sedimentary textural and structural characteristics of a sedimentary sequence and determination therefrom of its palaeogeographic setting.

25.4122 Seismic Stratigraphy and Log Analysis S1 L1T1
Structural and stratigraphic interpretation of seismic records at both regional and prospect scales. The application of wire-line logs to stratigraphic analysis and formation evaluation and the integration of log and seismic data in sedimentary basin analysis.

25.4123 Geology of Selected Oil and Gas or Coal Fields S1 L1T1
Literature study and seminars on typical Australian and, in particular, overseas productive regions and fields.

25.4124 Palynology or Foraminiferal Micropalaeontology S1 L1T1
Laboratory based studies in the application of palynology to geological problems; or, use of foraminifera in dating, correlation and stratigraphical subdivision; also diagnostic techniques as applied to principal zonal species.

25.4141 Mineral Exploration S1 L1½ T1
The use of geology in mineral exploration and area selection involving the development of conceptual models, the organization of exploration programs, radiometric methods, exploration ground tenure in New South Wales and exploration drilling.

25.4142 Geological Sampling and Analytical Methods S1 L1T1
Methods of collection of samples in exploration geochemistry including waters, soils, drainage sediments and rocks. Methods in estimating and monitoring sampling and analytical errors. Determination of selected elements in soil and stream samples by atomic absorption, fluorometric, specific ion electrode and colorimetric methods.

25.4143 Research Project S1 L1T1½
An integrated study involving literature review and laboratory analysis of an appropriate mineralized environment.

25.4151 Hydrogeology S1 L1T2

25.4152 Engineering Geology S1 L1T2

25.4153 Environmental Geology S1 L1T2
Geological factors in waste disposal — domestic, industrial and radioactive. Environmental parameters of coasts and beaches.

25.4154 Engineering Project S1 L1T3
A field and laboratory project in an aspect of engineering geology.

25.420 Field Project S2
A major field-laboratory project, which generally includes geological mapping, on some aspect of mineral or sedimentary basin resources, engineering or environmental geology or resource geophysics.

25.510 Geology for Geomorphologists and Pedologists S1 L1T1; S2 L2T2
Prerequisites: 25.211, 25.221.

25.5112 Geology for Civil Engineers S1 L2T1
An introduction to mineralogy, petrology, structural geology, stratigraphy and geomorphology. Weathering of rocks and development of soils. The role of the geologist in civil engineering.

25.520 Geology for Mining Engineers 1 F L1T1
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 rockforming 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 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 subject is divided equally between lectures and laboratory work. Field Tutorial hours are additional.
25.5212 Sedimentology  
Prerequisite: 25.120. Excluded: 25.212.
As for Sedimentology in 25.212 Earth Environments 1. Available only to Course 3145.

25.523 Mineralogy  
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.

25.530 Geology for Mining Engineers 2  
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 and properties of coal, oil, oil shale and natural gas; stratigraphic and structural considerations in exploration and development of coal and petroleum deposits. 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.

25.531 Physical Geology  
for Petroleum Engineers 1  
Introduction to earth science, the constitution of the earth, rock composition, rock types and processes of formation and deformation, organic evolution, geological time, fluids in rocks, presentation of geological data.

25.532 Physical Geology  
for Petroleum Engineers 2  
Sedimentary petrology, sedimentary environments and facies, facies analysis, origins and formation of petroleum, exploration techniques, petroleum in Australia.

25.5302 Structural Geology  
for Petroleum Engineers  
Prerequisite: 25.301.
Origin and properties of both regional and local geological structures and petroleum traps. Delineation of structures and petroleum traps by geophysical methods.

25.5311 Aqueous Geochemistry  
Prerequisite: 25.221.
As for Aqueous Geochemistry in 25.311 Earth Materials 3. Available only to Course 3145. Note: Tutorials comprise 10 hours total in Session 1 only.

25.5312 Geological Field Mapping  
Prerequisite: 25.5212. Excluded: 25.312.
As for Field Mapping in 25.312 Earth Environments 2. Available only to Course 3145.

25.5313 Stratigraphy  
Prerequisite: 25.5212. Excluded: 25.312.
As for Stratigraphy, in 25.312 Earth Environments 2.

25.542 Mining Geology Project  
Note: Comprises 18 hours total in Session 2.

25.931 Gravity and Magnetic Methods  
Prerequisites: 1.001 and 10.001. It is desirable that students taking this unit have a background in geology.
Fundamental principles. Field procedures and instruments. Reduction of field data. Regions and residuals. Effects of sources of simple geometrical shapes and generalized two and three-dimensional distributions. Applications. Field work of one day is a compulsory part of the subject.

25.9312 Seismic Methods  
Prerequisites: 1.001 and 10.001. It is desirable that students taking this unit have a background in geology.

25.9313 Electrical Methods  
Prerequisites: 1.001 and 10.001. It is desirable that students taking this unit have a background in geology.
Introductory theory and field practice of resistivity, self-potential, induced polarization and airborne and ground electromagnetic methods. Geological interpretation of field data. Geophysical logging. Field work of one day is a compulsory part of the subject.

25.9315 Regional Geophysics  
Qualitative and quantitative appraisal of geophysical data for a selected area.
Servicing Subjects
These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Combined Sciences Handbook.

25.435 Geology Honours

25.621 Marine Geology 1 F L1T2
Prerequisites: 25.601 or both 25.110 and 25.120.
Sedimentology: Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition: alluvial, nearshore, shelf and deep sea, in both terrigenous clastic and carbonate evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. 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. Mineralogy and Petrology: Igneous and sedimentary rock types of the ocean floor and their significance. Field work of five days is a compulsory part of the subject.

25.622 Hydrological and Coastal Surveying F L1T2
Prerequisites: Nil.
General principles of surveying, with particular reference to coastlines and off-shore techniques. Optical and electronic methods of distance measuring and position fixing. Methodology for short-term and long-term measurement of tides and flow currents. Bathymetric surveys in shallow and deep water conditions. Coastline morphologies and their relationship to the behaviour of water masses. Analysis of sedimentary systems in deltaic, estuarine and near-shore environments. Data collecting, processing and storage. Shallow-water investigations for bedrock morphologies. Field work of five days is a compulsory part of the subject.

25.631 Marine Geology 2 F L1T2
Prerequisite: 25.621.
Prerequisite: Nil.

25.6341 Marine Mineral Deposits and Oceanic Minerals S1 L1T1

25.6342 Exploration and Seismic Methods S2 L2T1
Geophysics of ocean basins and off-shore areas and the techniques of their study. Seismic refraction, reflection and computational methods, instrumentation of seismic and acoustic sources, recording systems and signal processing. Geological and physical interpretation of results. Practical work on instrumentation, recording and interpretation of field data.

25.9314 Geological Applications S1 L1T1
Prerequisite: 25.120.
A subject of ten weeks' duration. Structural Geology: Elements of structural geology, stereographic projection and fracture analysis. Geology of Fuels: Origin of coal, oil and natural gas; stratigraphic and structural consideration of oil and coal fields. Hydrogeology: Principles of hydrogeology; transmission of groundwater in rocks and soils. Field work of one day is a compulsory part of the subject.

25.9321 Geophysical and Geological Applications S2 L1T2
Prerequisite: 25.120. Excluded: 25.6342.
Graduate Study

Departments of Mining Engineering and Mineral Processing and Extractive Metallurgy

Mining Engineering and Mineral Processing and Extractive Metallurgy are Departments within the School of Mines. Generally these subjects are of three hours duration per week or multiples of that time.

7.001G Exploratory Drilling

7.111G Mining Engineering

7.122G Mining Engineering Technology

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

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: 7.7341 or equivalent.

7.322G Mineral Beneficiation Technology
Prerequisite: 7.311G or equivalent.
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

7.332G Mineral Engineering Laboratory  
Prerequisite: 7.311G or equivalent.  
Laboratory investigations may be selected from the following according to availability and specialization: metalliferous ore concentration; coal preparation; beneficiation of non-metals; processing of mineral fluids.

7.351G Mineral Beneficiation  
Prerequisite: 7.3342 or 7.311G or their equivalent.  
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. Flow-sheet 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 1  

7.362G Minerals Engineering 2  


7.363G Minerals Engineering Laboratory  
S1 T3  
A series of laboratory investigations relating to material covered in subjects 7.361G and 7.362G.

7.364G Minerals Engineering 3  
S2 L4 T4  

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, no-liability, 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.
7.55X Subsidence Engineering F 2

Trough subsidence resulting from the extraction of bedded mineral deposits. Parameters influencing subsidence. Subsidence-related phenomena causing damage to structures at or below the surface. Measurement and empirical prediction. Theories and modelling of subsidence. Control of subsidence.

7.58X Economics and Management of Geomechanics Projects F 2


7.917G Fire and Explosion S1 or S2 L2

Chemistry and physics of combustion reactions; types of flames; deflagration and detonation; ignition; fire point; flammable limits. Industrial fuel-fired appliances; fire risks in buildings; fire fighting equipment; flame proofing; fire and explosive risks in chemical process industries; case studies. Use of appropriate standards and legislation. Fire research; insurance.

7.93G Hydrogeochemistry S1 L1.5 T1.5 C3

Department of Applied Geology

25.702G Hydrogeology  S1 L1½ T1½ C3**
Occurrence of groundwater in sedimentary, igneous and metamorphic rocks; hydrogeology of extreme climatic zones, arid and tropical; aquifer types in porous and fractured rocks. Regional groundwater basins, case histories; Great Artesian Basin. Hydrogeological mapping and applications. Exploration for groundwater. Groundwater behaviour and aquifer characteristics; storage and release of water; transmission in permeable and low permeable materials. Groundwater flow; 2 & 3 dimensional, radial, steady and transient flow, pump test analyses, flownets, boundaries. Practical extraction technology (advanced and simple); well design, pumps and testing of wells. Drilling techniques and programs, well completion. Monitoring, data logging technology. Groundwater management, conjunctive use, administration and law.

25.703G 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.

25.704G Environmental Geology  S1 L1½ T1½ C3

25.705G 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, electro-magnetic 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.

25.706G Geological Basis of Geomechanics  S1 L2T1

25.707G Geopollution Management  S1 L1½ T1½ C3

25.707X Geopollution Management  S1 L1½ T1½ C3

25.708G Engineering Geology  S1 L2T1
Co-requisite: 25.706G.
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, RQD, 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. Field tutorials: Several field tutorials are included.

25.710G Coastal Environmental Geology  S1 L1½ T1½ C3
the water environment. Investigation techniques. Marine hydraulic works: sewage disposal, thermal pollution.

25.711G Arid Zone Engineering Geology S1 L2T1 C3

25.712G 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 Fowler's Gap Research Station. A report is required.

25.713G 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 Fowler's Gap Research Station. A report is required.

25.714G Geology of Foundations S1 L2T1
A detailed review of case histories of the geological factors influencing the foundations of dams, buildings, bridges, roads and airfields. The geology of large underground cavities. Methods of geological investigation.

25.715G Sources of Waste and Landfill Disposal S1, C3 L2T1; S1, external C3
Sources of solid and liquid wastes, design and operation of landfills, processes within landfills, re-use and planning of sites, transport and disposal of waste.

25.716G Groundwater Geophysics S1 L1½ T1½ C3
Fundamentals and theory of the gravity, magnetic, electrical, electromagnetic and seismic geophysical methods. Relationships between geophysical and hydrogeological properties of earth materials. An introduction to geophysical well logging. Applications of geophysics to regional and detailed groundwater exploration and development, including surface and airborne techniques. In particular: location of water table, stratigraphic detail, determination of bedrock depth, water quality, porosity and pollution plumes, salinity mapping, saltwater-freshwater interfaces, fracture and cavity detection.

25.717G Computing for Groundwater Specialists S1 L1½ T1½ C0
Introduction to FORTRAN programming, mainframe, microcomputer operation systems, databases, spreadsheets, statistical and graphical packages with applications relating to groundwater processes.

25.718G Remote Sensing of Groundwater Resources S3 L1 T½ C3
The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared 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 database as applied to exploration. Remote sensing for hydrogeological mapping, recognition of aquifers and recharge, discharge zones, salinity mapping. Application of Landsat TM, SPOT, RADAR and integrated information systems.

25.719G Groundwater Research Project S2 C18
Research investigation consisting of one or more of: modelling, laboratory experiments, field work related to hydrogeology and groundwater management.

25.720G Groundwater Project S2 C12
Study of similar content to 25.719G but at a smaller scale.

25.800G Seminar S1* T2
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 1 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, groundwater, mineral and engineering exploration. Treatment includes fundamental aspects of the method and case histories illustrating applications areas. Field tutorial survey camp: An integrated, geological, geophysical and geochemical field tutorial survey camp of seven days' duration is an integral part of this subject.

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
FORTRAN and computer programming; use of terminal facilities. Basic data storage and retrieval. Simple interpretative procedures for exploration data.
25.805G Resource Economics 1 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 practice 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 radiometric 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 copper, 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 2 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 Geological 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.

25.821G Geology in Exploration 2 S1† L2
Specialized search techniques for selected types of metallic ores, with appropriate case histories.

25.823G Advanced Exploration Geochemistry S1† L2 T6
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-history of actual surveys. Special consideration is given to problems of applications under Australian conditions.

25.824G Advanced Data Processing and Interpretation S1† L2 T2
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† L1 T3
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.

25.831G 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 and 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 geophys-
ics, including instrumentation, manual and electronic data processing and interpretation. Specific application 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/geochemical exploration.

25.840G Seminar S1† T2
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.
†Weeks 8-14 only.
Servicing Subject Descriptions
Servicing Subject Descriptions

Undergraduate Study

Physics

Physics Level I Units

1.001 Physics 1  F L3T3

Prerequisites:

HSC Exam Score Range

Required

2 unit Mathematics* or 67.100
3 unit Mathematics or 1.50
4 unit Mathematics or 1.100 or
and

60-100

2 unit Science (Physics) or
2 unit Science (Chemistry) or
3 unit Science or
4 unit Science or

1.001

31-100

Prerequisites: None. Co-requisites: 10.021A and 10.021B, 10.021B and 10.021C, or 10.001 or 10.011.

Physics Level II Units

1.002 Mechanics, Waves and Optics  S1 L3T1

Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2111. Excluded: 1.992, 10.4111, 10.4211.

1.012 Electromagnetism and Thermal Physics  S2 L3T1

Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2111. Excluded: 1.972, 1.992.

*This refers to the 2 Unit Mathematics subject which is related to the 3 Unit Mathematics subject. It does not refer to the subject 2 Unit Mathematics (Mathematics in Society).

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, inertia, 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.

1.021 Introductory Physics 1  F L3T3

(For Health and Life Scientists)

Prerequisites: None. Co-requisites: 10.021A and 10.021B, 10.021B and 10.021C, or 10.001 or 10.011.

Principally for students majoring in the life and health sciences disciplines. 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 radio-activity, geometrical optics, optical instruments, wave optics, microscopes and their uses.
ory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwell’s relations, phase diagrams, chemical and electrochemical potential.

1.022 Modern Physics
Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2112. Excluded: 1.9322, 1.982.
Special theory of relativity: time dilation, length contraction, simultaneity, Lorentz transformations, energy and mass. Photon properties, de Broglie relations, Uncertainty principle, operators in quantum mechanics, postulates of quantum mechanics, potential wells, steps and barriers, harmonic oscillator, H atom, angular momentum, magnetic moment, electron spin, nuclear spin. Atomic and molecular spectra, lasers, quantum statistics, free electron model of a metal, band theory; nuclear size, density, mass; nuclear models, fission and fusion, nuclear forces.

1.032 Laboratory
Prerequisites: 1.001 or 1.011, 10.001. Excluded: 1.9222.
Alternating current circuits, complex impedance, resonance, mutual inductance, introductory electronics, diode and 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.

1.062 Computer Applications in Experimental Science 2
Prerequisite: 1.061. Excluded: 1.042.
Interface between computer and experiment, programmed and interrupt interaction, direct and dual port memory access concepts, hardware, software and timing restraints. Real-world variables, transducers and conversion to binary representation, converters and counters, signals and noise. Data collection, reduction and storage as digital matrices. Numerical modelling, analysis and elementary control of a system.

1.9222 Electronics
Prerequisites: 1.001 or 1.002 or 1.021. Excluded: 1.032.
The application of electronics to other disciplines. Includes: principles of circuit theory and analogue computing; amplifiers, their specification and application, transducers; electronic instrumentation; industrial data acquisition.

1.023 Statistical Mechanics and Solid State Physics
Prerequisites: 1.012, 1.022, 10.2112.
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 models of metals, band theory, point defects, dislocations.

1.0343 Advanced Optics
Prerequisite: 1.02.
Fresnel and Fraunhofer diffraction, Fourier transforms, filtering, coherence length and time, stellar interferometers, laser theory, non-linear optics.

1.0533 Experimental Physics B1
Prerequisite: 1.032.
Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in 1.043 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and super-conductivity. Fourier optics, holography.

1.0543 Experimental Physics B2
Prerequisite: 1.032.
As for 1.0533 Experimental Physics B1.

1.1433 Biophysics
Prerequisites: 1.012, 1.022.

1.1533 Biophysical Techniques
Prerequisites: 1.012, 1.022, 1.032.
Theory and application of physical techniques of relevance to the study of biological systems. Techniques considered may include optical and electron microscopy X-ray and neutron diffraction, magnetic resonance, lasers, light scattering, calorimetry, fluorescence, electrochemical techniques and electrophysiological methods and dielectric measurements.

1.3033 Mechanical Properties of Materials
Properties of materials in relation to their structure: atomic and molecular structure of solids; elasticity, inelasticity, long-range (rubber) elasticity, viscoelasticity; plasticity; brittle fracture; viscosity and surface tension of liquids; adhesion; friction and lubrication.
1.713 Advanced Laser and Optical Applications  
F L1½T1½
Co-requisite: 1.002. See also Table 1.

Laser operation, characteristics, theory, design of such types as gas, ion, molecular, excimer and dye lasers. Filter design, multiple beam interference, etalon use, dielectric mirror design. Modulators, theory and application, electro and acousto optic phenomena. Detectors, types, basic theory and design. Solid state and vacuum tube systems. Non-linear optics, theory and applications. A design study and case history of a typical optical system. Materials processing fundamentals. Laser safety.

1.9422 Introduction to Physics of Measurement  
S1 L1½T1½
Prerequisites: 1.001 or 1.011. Excluded: 1.042.

Resolution: accuracy and sensitivity of instruments, errors of observation; experimental design; transducers; thermometry; electrical noise; servo systems, mechanical design of apparatus; optical instruments optical fibres; photometry; calorimetry; analogue to digital conversion and digital instruments; measurement of very large and very small quantities.

Chemistry

2.103B Organic Chemistry  
S1 L3T3
Prerequisite: 2.102B. Excluded 2.003B.

Heterocyclic Chemistry: synthesis and reactions of the following heteroaromatic systems: pyridine, quinoline, isoquinoline, pyrimidine, pyrrole, furan, thiophen, indole, imidazole; examples of naturally occurring alkaloids where relevant. Aliphatic Chemistry: stereochemistry of acyclic systems; classical and nonclassical strain in cyclic systems; stereochemistry and conformation of monocyclic and polycyclic compounds; synthesis, reactions and rearrangement of monocyclic compounds including stereochemical selectivity; transannular reactions in medium rings; synthesis and reactions of fused and bridged polycyclic systems; examples of steroids and terpenes where relevant. Structure Determination: application of spectroscopic methods (eg nuclear magnetic resonance, mass spectroscopy) to determination of organic structures.

2.003J Fundamentals of Biological and Agricultural Chemistry  
S1 L2T4
Prerequisites: 2.121 and 2.131, or 2.141. Excluded: 2013L, 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 structure, reactivity. Chemistry of monosaccharides, disaccharides and polysaccharides. Methods of analysis, chemical and physiochemical. 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.

2.030 Organic Chemistry  
S1 L2T4
Prerequisite: 2.102B.

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.

2.043L Chemistry and Enzymology of Foods  
F L2T4
Prerequisite: 2.102B. Excluded: 2.003J, 2.043L

The chemistry of food constituents at an advanced level and the relationship between the chemistry and enzymology associated with the origin and handling of foodstuffs. Treatment of the stability of constituents, changes in colour and texture occurring during processing and storage. Methods of assessment, chemical and physical. General classification of constituents, role of free and combined water. Fixed oils and fats, rancidity of enzymic and autoxidative origin, antioxidants — natural and synthetic — theories on mechanisms of action, carbohydrates, reactivity, role in brewing processes, carbohydrate polymers, starch structure, enzymic susceptibility and mode of action, estimations, enzymic degradation and enzymic browning, reactions and stability of natural pigments, vitamins, preservatives.

2.102A Physical Chemistry  
S1 or S2 L3T3
Prerequisites: 2.121 and 2.131, or 2.141, and 10.011 or 10.001 or 10.021B and 10.021C. Excluded 2.002A.


2.102B Organic Chemistry  
F or S2 L3T3
Prerequisite: 2.131 or 2.141. Excluded: 2.002B

Discussion of the major types of organic reaction mechanisms (eg addition, substitution, elimination, free-radical, molecular rearrangement) within context of important functional groups (eg aliphatic hydrocarbons, monocyclic aromatic hydrocarbons, halides, organometallic compounds, alcohols, phenols, aldehydes, ketones, ethers, carboxylic acids and their derivatives, nitro compounds, amines and sulfonic acids). Introduction to application of spectroscopic methods to structure determination.
2.102C Inorganic Chemistry and Structure S1 or S2 L3T3
Prerequisites: 2.121 and 2.131, or 2.141. Excluded: 2.042C.

2.102D Chemical and Spectroscopic Analysis S1 or S2 L3T3
Prerequisites: 2.121 and 2.131, or 2.141; and 10.011 or 10.001 or 10.021B and 10.021C. Excluded: 2.002D and 2.003H.

2.102E Organic and Inorganic Chemistry for Chemical Engineers S1 L4
Prerequisites: 2.121 and 2.131 or 2.141
Discussion of selected types of organic reactions (eg addition, substitution, elimination, free radical, rearrangement) to provide a broad cover of the chemistry of aliphatic hydrocarbons, halides, alcohols, ethers and amines. Addition reaction of aldehydes and ketones. Substitution reactions of acid derivatives. Chemistry of benzene and its derivatives with a brief extension to include naphthalene chemistry.
Survey of geometrical structures, energetics, bonding, reactions and reactivity, spectroscopic and magnetic properties of representative inorganic compounds, including selected main group compounds, compounds of selected transition metals and rare earth elements, and coordination complexes. Applications of inorganic chemistry.

2.111 Introductory Chemistry S1 L2T4
Prerequisite: Nil.
Note: 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 prerequisites are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 must pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.
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 and selected elements. Acids, bases, salts, neutralization. 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 1A S1 or S2 L2T4
Prerequisites:
HSC Exam Score Range Required
2 unit Mathematics* or 67-100
3 unit Mathematics or 1-50
4 unit Mathematics and 1.100
2 unit Science (Physics) or 53.100
2 unit Science (Chemistry) or 53.100
4 unit Science or 1-50
3 unit Science or 90-150
2.111
*This refers to the 2 Unit Mathematics subject which is related to the 3 Unit Mathematics subject. It does not refer to the subject 2 Unit Mathematics (Mathematics in Society).
Note: 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 prerequisites are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 must pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.

2.123E Environmental Chemistry S2 L3T3
Prerequisites: 2.102A and 2.102D. Excluded: 2.043A.

2.131 Chemistry 1B S1 or S2 L2T4
Prerequisite: 2.121.
Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria; buffers, titrations, chemical analysis. Oxidation and reduction reactions, electrode potentials. Chemical thermodynamics, entropy, free energy. Chemistry of carbon compounds, stereosomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines.
Note: Students who have passed 2.111 may be permitted to enrol in 2.131 on application to the Head of the School of Chemistry.
2.141 Chemistry 1M  F L2T4

Prerequisites:

<table>
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<tr>
<th>HSC Exam</th>
<th>Score Range</th>
<th>Required</th>
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<tbody>
<tr>
<td>2 unit Mathematics*</td>
<td>67.100</td>
<td>1-50</td>
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<tr>
<td>3 unit Mathematics</td>
<td>1-100</td>
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<tr>
<td>4 unit Mathematics and 2 unit Science (Chemistry) or 4 unit Science or 3 unit Science</td>
<td>60-100</td>
<td>1-50</td>
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<td>or 2.111</td>
<td>90-150</td>
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</tbody>
</table>

*This refers to the 2 Unit Mathematics subject which is related to the 3 Unit Mathematics subject. It does not refer to the subject 2 Unit Mathematics (Mathematics in Society).

Note: As for Note 2.121 Chemistry 1A.

The syllabus is an integrated one of 2.121 and 2.131 (see above). Students majoring in Chemistry may take 2.141 in lieu of 2.121 and 2.131.

2.951 Chemistry 1ME  S1 L3T3

Prerequisite: As for 2.121.

A treatment of chemistry which illustrates the application of the principles of chemistry to problems of concern to mechanical engineers. Topics: chemistry of materials, thermochemistry, chemical kinetics and equilibrium, radioactivity and nuclear power, electrochemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. Surface chemistry.

Mechanical and Industrial Engineering

5.0011 Engineering Mechanics 1  S1 or S2 L2T2

Prerequisite: HSC Score

<table>
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<td>2 unit Science (Physics) or 4 unit Science (multistrand)</td>
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<tr>
<td>or 2 unit Industrial Arts or 3 unit Industrial Arts</td>
<td>53-100</td>
<td>1-50</td>
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</table>

Excluded: 5.010, 5.0101, 5.0201.

Note: Students who wish to enrol in this subject in courses other than the full-time courses in Aeronautical Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.

5.0012 Introductory Engineering Design and Materials Science  S1 or S2 L2 T0

Excluded: 5.0016, 5.010.

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: Structure and properties of main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.0300 Graphical Analysis and Communications  S2 L1T2

Excluded: 5.0016, 5.030, 5.0302.

Descriptive geometry as the basis of analysis and synthesis of spatial relationships: points, lines, planes, solids, intersections. Orthographic and other projection systems. Engineering drawing as a means of definition and communication, selection of views of constructions, drawings, conventions, dimensions and tolerancing. Introduction to computer-based drafting systems.

5.0302 Engineering Drawing and Descriptive Geometry  S1 or S2 L1T3

Excluded: 5.0016, 5.030.


5.0305 Manufacturing Technology  S2 L/T3


Description of the processes classified as: forming from liquid or solid, material removal, material joining. Elementary mechanics of forming and cutting processes. Analysis of the primary functions of machine tool structures and their operation. Relationship between product design and manufacture processes. Elementary functional analysis of product designs, including linear loop equations, limits and fits, dimensional accuracy of processes and alternate design and manufacturing strategies.

5.122 Mechanical Engineering Design 2  F L1T2

Prerequisites: 5.010, 5.030. Co-requisites: 5.0201, 5.061, 5.422, 5.620, 5.626.

5.3021 Engineering Mechanics 2A

Prerequisites: 1.001 or 1.951, 5.0201 or 5.0011, 10.001 or 10.011. Excluded: 5.300.

Kinetics of system of particles, plane steady mass flow. Plane kinematics and kinematics of rigid bodies, mass moment of inertia, differential equations of motion, work, energy, impulse and momentum. One degree of freedom vibrations, free, forced, underdamped, damped, transmissibility.

5.3022 Engineering Mechanics 2B

Prerequisites: 1.001 or 1.951, 5.3021, 10.001 or 10.011.

Transverse vibrations of beams. Whirling of shafts. Motion relative to a rotating and moving frame. Virtual work for static and dynamic systems. Kinematics and kinetics of simple mechanisms.

5.620 Fluid Mechanics 1

Prerequisites: 1.001 or 1.951, 5.010, 10.001 or 10.011. Co-requisite: 5.300. Excluded: 5.622.


5.626 Thermodynamics 1

Prerequisites: 1.001 or 1.951, 5.010, 10.001 or 10.011. Excluded: 5.622.


6.611 Computing 1

Prerequisite: As for 10.001. Co-requisite: 10.001 or 10.001 or 10.011. Excluded: 6.000, 6.620.

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. Introduction to propositional logic, computing machinery, computer arithmetic, artificial intelligence, and operating systems.

6.621 Computing 2A

Prerequisites: 6.611, 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 Computing 1. Systematic program 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.

6.854 Electrical Power Engineering

Prerequisite: 1.001 or equivalent (1.9222 or 6.851 for students in Course 3140).

Extensive introduction to the theory and application of heavy current electrical engineering. Commences with the requisite circuit theory and then proceeds to consideration of the distribution of electrical power and the characteristics and selection of electrical machinery. DC power supplies, three-phase AC supply, voltage regulation, transformers, AC and DC machines and their rating; a project illustrating the application of electrical engineering to various aspects of industry. Consists of one 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. Detailed lecture notes are provided.

6.856 Electronics for Measurement and Control

Prerequisites: 5.010, 10.001 or 10.011, 18.013. Excluded: 6.010, 6.020.

The use of electronics in mechanical systems and the processing of signals by analog and digital techniques. Revision of basic circuit theory, operational amplifier circuits, feedback and filtering. Digital logic using integrated circuits. Noise. Techniques for A/D and D/A conversion, measurement system interfacing to microprocessors.
Civil Engineering

8.1130 Engineering Drawing S1 L1T2
Fundamental concepts of descriptive geometry, orthographic drawing, first and third angle drawing, isometric and perspective drawing, Australian standard engineering and drawing practice, application of descriptive geometry to common problems in civil engineering, graphic communications, introduction to computer graphics.

8.6110 Structures S1 L1T2

8.6130 Properties of Materials F L1T1

Mathematics

10.001 Mathematics 1 F L4T2
Prerequisite: HSC Exam Score Range Required
2 unit Mathematics or
3 unit Mathematics or
4 unit Mathematics or
10.021B.
Excluded: 10.011, 10.021B, 10.021C.

10.011 Higher Mathematics 1 F L4T2
Prerequisite: HSC Exam Score Range Required
3 unit Mathematics or
4 unit Mathematics
Excluded: 10.001, 10.021B, 10.021C.

10.021B General Mathematics 1B S1 L4T2
Prerequisite: HSC Exam Score Range Required
2 unit Mathematics or
3 unit Mathematics or
4 unit Mathematics or
10.021A
Excluded: 10.011, 10.001.

10.021C General Mathematics 1C S2 L4T2
Prerequisite: 10.021B. Excluded: 10.001, 10.011.

10.022 Engineering Mathematics 2 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.
10.031 Mathematics  
F L1T1  
Prerequisite: 10.001 or 10.011 or 10.021C (CR).  
Note A: A unit, together with 10.032, which is available to Faculty of Science students as one of a sequence of two units constituting a terminating service course in mathematics. As such it is mutually exclusive to any other Level II or Level III unit in, Pure and/or Applied Mathematics and/or Theoretical Mechanics except that 10.412A may be taken with 10.031 and 10.032.  
Note B: Mathematics 10.031 is included for students desiring to attempt only one Level II Mathematics unit. If other Level II units in Pure Mathematics, Applied Mathematics or Theoretical Mechanics are taken, 10.031 Mathematics will not be counted.  
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.  
Note A: As for Note A in 10.031 Mathematics.  
Note B: 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.  
Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

10.1113 Pure Mathematics 2 — Multivariable Calculus  
S1 or S2 L1½T1  
Prerequisite: 10.001 or 10.011. Excluded: 10.1213.  
Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.2111 Applied Mathematics 2 — Vector Calculus  
S1 or S2 L1½T½  
Prerequisite: 10.001. Excluded: 10.2211.  
Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics 2 — Mathematical Methods for Differential Equations  
S1 or S2 L1½T½  
Prerequisite: 10.001. Excluded: 10.2212.

Accounting

14.501 Accounting and Financial Management 1A  
S1 or S2 L2T2½  
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 auditing.

14.511 Accounting and Financial Management 1B  
S1 or S2 L2T2½  
Prerequisite: 14.501.  
Development of basic concepts introduced in 14.501 Accounting and Financial Management 1A, including corporate reporting, business finance, system design, elementary computer applications.

14.522 Accounting and Financial Management 2A  
S1 or S2 L2T2½  
Prerequisites: 14.511 plus  

<table>
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<th>HSC minimum mark required</th>
<th>2 unit Mathematics or</th>
<th>3 unit Mathematics</th>
<th>4 unit Mathematics</th>
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<td>60</td>
<td>1</td>
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</table>
The design, production and use of accounting and other quantitative information in the planning and control of organizations, with particular reference to manufacturing activities.

14.542 Accounting and Financial Management 2B  S2 L2T½
Prerequisite: 14.511 plus HSC results as for 14.522.
Critical examination of concepts and problems in income measurement, asset valuation and financial reporting for various forms of business undertaking with particular reference to corporate organizations, including associated aspects of auditing and taxation and methods of accounting for changing prices.

14.606 Management Information Systems Design  S2 L2T1
Organizational impact, information systems design methodologies, requirements elicitation, logical and physical design, implementation procedures, principles of data management, data analysis, telecommunications networks, systems design in a distributed environment, commercial programming practice, systems development case studies using spreadsheet, file management and word processing software.

14.613 Business Finance 2A  S1 or S2 LT3
Prerequisite: 14.511, 15011 and 15.421.
The essential aspects of financial decision-making in business including: factors influencing capital expenditure decisions; alternative approaches to valuation; factors affecting the formulation of the capital structure; influence of the capital market environment.

14.774 Legal Environment of Commerce  S1 or S2 L2T1
Prerequisite:  15.774.
The Australian legal system and areas of substantive law relevant to commerce including contract, business organization, employment, commercial arbitration, advertising, trade regulation, civil compensation, discrimination.

14.776 Legal Regulation of Commerce  S1 or S2 L2T1
Prerequisite: 14.774.
The regulation of restrictive trade practices and sales promotion. The legal framework of marketing strategy with special reference to anti-competitive practices (including collusive activity, exclusive dealing, price discrimination, resale price maintenance, mergers and monopolization) and consumer protection law (including misleading and deceptive advertising and other unfair practices). Consumer credit; product liability; protection of intellectual property.

Commerce and Economics

15.101E Microeconomics 1  S1 or S2 L2T½
Prerequisite: 2 unit English (General) or 2 unit English or 3 unit English

15.102E Macroeconomics 1  S1 or S2 L2T½
Prerequisite: 15.101E.
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 market equilibrium and disequilibrium situations, inflation and the balance of payments.

15.201E Microeconomics 2  S1 L2T2
For students first enrolling in 1989 — Commerce prerequisite: 15.102E
Arts/Applied Science/Sciences prerequisites: 15.102E, 15.103M
Co-requisite: 15.203M.
Excluded: 15.221E, 15.203E.
For students who first enrolled before 1989 — Commerce prerequisite: 15.011.
Applied Science/Sciences prerequisites: 15.011 plus 15.401 or 15.411 or 10.001 or 10.011.
15.302E Macroeconomics 3

For students first enrolling in 1989 —
Prerequisites: 15.201E, 15.202E and 15.203M.
Excluded: 15.322E

For students who first enrolled before 1989 —
Commerce prerequisite: 15.042 or 15.052.
Arts/Applied Science/Sciences prerequisite: 15.042 or 15.052.

Macroeconomic theory and policy including an introduction to the theory of economic policy, the structure and dynamic characteristics of macro-models, fiscal policy, monetary policy and policy, inflation and unemployment. Rational expectations Macroeconomic policy in Australia.

15.202E Macroeconomics 2

For students who first enrolled before 1989 —
Commerce prerequisite: 15.011.
Arts/Applied Science/Sciences prerequisite: 15.002 plus 15.401 or 15.403. Excluded: 15.052 and 15.072.


15.203E Applied Microeconomics

Commerce prerequisite: 15.102E.
Arts/Applied Science/Sciences prerequisite: 15.102E and 15.103M or 15.104M.
Excluded: 15.201E, 15.221E.

For students who first enrolled before 1989 —
Commerce/Arts/Applied Science prerequisite: 15.011.
Excluded: 15.012 and 15.002.

Structural change in the Australian economy. The effect of different market structures on firms and consumer welfare. The consequences of markets failure and the effects of government regulation. Investment decisions in the public and private sectors, including the estimation of future benefits, revenues and costs, the measurement of consumer and producer surplus. The economics of non-renewable and other resources. Australia’s international trade and investment and the effects of restrictions on international trade and investment.

15.204E Applied Macroeconomics

Commerce prerequisite: 15.102E.
Arts/Applied Science/Sciences prerequisite: 15.102E and 15.103M or 15.104M.
Excluded: 15.202E, 15.222E.

For students who first enrolled before 1989 —
Commerce/Arts/Applied Science/Sciences prerequisite: 15.011.
Excluded: 15.052 and 15.042.


15.205E Marxian Political Economy

Prerequisite: 15.102E.

For students who first enrolled before 1989 —
Commerce/Arts/Applied Science 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.

15.207E Natural and Environmental Resources Economics

Prerequisites: 15.201E or 15.221E or 15.203E.

For students who first enrolled before 1989 —
Prerequisite: 15.002 or 15.012 or 15.072.

Classification of renewable and non-renewable resources: reserves, resources and resource base, the concept and measurement of resource scarcity, costs, prices and rents; exhaustion of resources, ore quality, exploration, availability of substitutes; uncertainty of discovery, technical progress, market imperfections; renewable resources, sustainable yield concepts. Policy issues, with particular reference to Australia’s role in the international economy.

15.241E Economics of Developing Countries

For students who first enrolled before 1989 —
Commerce/Arts/Applied Science prerequisite: 15.072 or 15.103 or 15.113.

Aspects of economic development in the less developed countries. Characteristics of these countries and the policies available to them, simplified models of under-development, phenomenon of structural change in the development process, role of industrialization in promoting structural change, international relationships of developing countries and strategies of development based on industry or agriculture.

15.243E Public Finance

For students who first enrolled before 1989 —
Commerce/Applied Science prerequisite: 15.002 or 15.012 or 15.072.
Arts prerequisite: 15.002 or 15.012 or 15.072 plus 15.421 or 15.403.
General aspects of public sector expenditure and its financing with special reference to Australia: 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 services systems; inflation and tax indexation; loan finance and the public debt; fiscal policy, the Budget and the economy.

15.247E Public Sector Economics  S1 or S2 L2T1
For students who first enrolled before 1989 —
Commerce/Arts prerequisite: 15.002 or 15.012 or 15.072.
Applied Science prerequisite: 15.002 or 15.012 or 15.072 with the approval of the Head of the Department of Economics.

15.301E Microeconomics 3  S1 L2T2
Prerequisites: 15.201E, 15.202E and 15.203M. Exclusion: 15.321E.
For students who first enrolled before 1989 —
Commerce prerequisite: 15.002 or 15.012.

15.208E Industry Economics and Australian Industrial Policy  S1 or S2 L2T1
Prerequisite: 15.201E or 15.221E or 15.203E.
For students who first enrolled before 1989 —
Commerce/Applied Science prerequisite: 15.002 or 15.012 or 15.072.
Arts prerequisites: 15.403 or 15.421 plus 15.072 or 15.012 or 15.002.
Structure of industry; inter-relationships 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 (e.g. motor vehicles, electronics, steel, petroleum).

15.211E Managerial Economics  S1 L2T1½
Prerequisites: 15.101E and 15.102E.
The application of economic concepts and analysis to managerial decision making. The relevance of opportunity cost and marginal analysis. Introduction to linear programming as a tool for managerial decision making. Production and cost analysis and measurement, with applied examples. Market and demand analysis and forecasting with applied examples. Problems of price setting. The role of non-price competition, such as advertising. The cost of capital and capital budgeting. An introduction to risk.

15.501 Introduction to Industrial Relations  S2 L2T1
For students enrolled in Faculties other than Commerce and Arts. Designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Includes: 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 NSW 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.
For further information regarding the following subject see the Faculty of Arts Handbook.

15.511 Industrial Relations 1A  S1 or S2 L2T1½
Commerce/Arts prerequisite: 15.901. Applied Science/Arts/Sciences prerequisite: 15.901. HSC minimum mark required

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Multi-disciplinary introduction to a range of important concepts and issues in industrial relations. Political, social, economic, legal, historical and psychological aspects of the evolution and operation of modern employer/employee relations with material drawn from both Australian and overseas experience. The nature and implications of: strikes, lockouts and other forms of industrial conflict and alienation; the structure and policies of State and Federal trade unions, the State labor councils and such peak organizations as the Australian Council of Trade Unions; the employer industrial relations function and the structure and policies of employer associations; processes of work rule determination, such as collective bargaining, mediation, conciliation and compulsory arbitration; labour movements; and the role of the various arbitration tribunals and government instrumentalities with respect to industrial relations.

15.902 Management Strategy and Business Development  S2 L2T1½
Commerce prerequisite: 15.901. Applied Science/Arts/Sciences prerequisite: 15.901. HSC minimum mark required

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The strategy and structure of large scale business enterprise over the past century. An analysis of the process of growth from small family firms and partnerships to corporate enterprises and multi-national corporations. The external business environment
Case studies of managerial hierarchies, investment strategy and diversification of firms in transport, mass retailing and mass production.

18.121 Production Management

Prerequisites: 10.031, 10.331.

Engineering economy: Economic objectives of the firm. Economic measure of performance: net present value, annual equivalent value 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, queuing theory, inventory models, simulation.

18.1211 Production Management A

Prerequisites: 10.031, 10.331 or 10.021B, 10.021 C, 13.200.

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 organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. Introduction to inventory control: Analysis of some engineering planning decisions.

18.1212 Production Management B

Prerequisites: 18.1211.

Engineering economy: Economic objectives of the firm. Economic measure of performance: net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. Introduction to operational research: Formulation and optimization of mathematical models of industrial processes. Development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queuing 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, queuing theory, inventory models, simulation.
18.551 Operations Research
F L2T1
Prerequisites: 5.0721, 10.022, 10.351. Excluded: 6.646.
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; simulation. These techniques applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

Marketing

28.012 Marketing Systems
S1 L2T2
Prerequisite: Nil.
Conceptual introduction to marketing from the systems viewpoint. 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 and 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.

28.052 Marketing Research
S2 L2T2
Prerequisite: 15.421 or approved substitute.
Sources and types of marketing information. Design, conduct, analysis and reporting of market surveys and experiments. Technique of statistical inference.

28.073 Strategic Marketing
S1 L2T2
Prerequisites: 28.012 and 28.052.
Conceptual framework relevant to the practice of marketing management for the further development of an integrative understanding of the market function. Important extensions and limitations of customer orientation and the emergence of a broader concept of marketing; stages of development of a marketing operation, the central role of innovation in opportunity management and the concept of control; importance of product life cycle concept to the formulation of marketing strategy; relationships between corporate and marketing strategy; marketing strategy, future analysis and scenario construction.

28.083 Managerial Marketing
S2 L2T2
Prerequisite: 28.073.
Application of theoretical marketing concepts developed in ‘Strategic Marketing’ and quantitative techniques developed in ‘Marketing Models’. Based on the planning, implementation and appraisal of a major field study.

Surveying

29.441 Surveying for Engineers
S1 or S2 L2T4

29.491 Survey Camp
A one-week field camp for students studying 29.441 Surveying for Engineers.

Town Planning

Core Subject

36.411 Town Planning
S1 L2T1
Architecture prerequisite: 11.4308 and 100 credit points.

Landscape Architecture

Students should contact the Head of School before enrolling in any of the following subjects.

37.1616 Land Systems
S2 L1T1
Prerequisite: 37.5505.
An investigation of resources and their management in relation to a range of land use types with an emphasis on an ecological approach. Management of both natural and cultural landscapes within the context of marine, coastal, estuarine and terrestrial environments. Studies of specific examples and the effects of human impacts. Methods of conservation and rehabilitation considered. Field excursions.

37.9105 Landscape Planning 1
S1 L2T2
Prerequisite: 37.1504.
Basic methods and techniques of resource data collection, analysis and valuation. History of landscape planning in Australia and overseas with reference to pioneering case studies. Projects include the use of maps, air photos and simple computer programs.
Classification of planning methods. Study of complex methods and techniques used in recent landscape planning models. Development of land use suitability models for recreation, residential, industrial, commercial, grazing, agriculture, forestry and conservation. Projects include the use of remote sensing techniques and advanced computer programs.

Biochemistry

41.101 Biochemistry

Prerequisites: 17.041, 2.121 and 2.131, or 2.141. Excluded: 2.003J.

Prerequisites: 2.121 and 2.131, or 2.141. 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 relationship between structure and function of enzymes, other proteins, hormones and biological membranes, metabolic networks and control mechanisms. The molecular mechanism of gene expression and protein synthesis. Photosynthesis. Practical work to amplify the lectures.

Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

42.101 Introduction to Biotechnology

Prerequisites: 2.121 and 2.131, or 2.141; 17.041; 10.011 or 10.001 or 10.021B and 10.021C.

An introduction to biotechnology as a multidisciplinary subject, dealing with the application of biochemical systems or their products in industry. Industrial uses include: production of single products (such as amino acids, vitamins, antibiotics etc), single cell protein, alternate fuels from renewable resources and fermented foods and beverages; biological waste treatment; aspects of pollution control, biodeterioration and biodegradation; and principles of enzyme technology. Concepts relevant to productivity in these systems, including: thermodynamic feasibility, techniques of environmental and genetic manipulation, choice of the appropriate biological catalyst(s) for a particular process, regulation of gene activity. The laboratory component emphasizes the manipulation of different classes of microorganisms and the use of biochemical products involved in a variety of biotechnological areas.

42.102A Biotechnology A

Prerequisites: 41.101 and 42.101 or 44.101 (Pass Conceded (PC) or Terminating Pass (TP) awarded prior to Session 2, 1983, is not acceptable).

The basic principles involved in the operation of microbial processes on an industrial scale. Includes: 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; the principles involved in microbial processes for chemical, pharmaceutical and food production, microbial waste treatment and environmental control. The laboratory component includes manipulation of micro-organisms, laboratory-scale fermenter operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars.

42.102B Biotechnology B

Prerequisite: 42.102A (Pass Conceded (PC) or Terminating Pass (TP) awarded prior to Session 2, 1983, is not acceptable).

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 teaching 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 are 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.

4.102C Microbial Genetics

Prerequisites: 41.101 or 44.101. Excluded: 43.102.

A detailed study of the mutational basis of microbial variation. Mutagens: mechanisms of mutagenesis; induction, enrichment, isolation and characterization of mutants; mechanisms of repair of mutational damage. Systems of gene transfer and recombination in fungi, bacteria and viral viruses; the use of these systems in constructing genetic maps, and as tools for probing aspects of microbial physiology and biochemistry. Genetic control of gene expression; the operon concept and its application to specific regulatory systems. Genetic code, co-linearity between a gene and its product, genes within genes, suppression of mutations. Restriction and modification of DNA; genetic engineering — its implications and prospects. Genetics of nitrogen fixation.

42.103 Biotechnology (Honours)

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects.
42.114 Fermentation Processes

Factors governing the use of micro-organisms in industrial processes, including the selection, maintenance and improvement of micro-organisms, the control of environmental factors, batch and continuous flow operational patterns, product recovery, process optimization and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.

42.103 Biotechnology (Honours)

Advanced formal training in selected areas of biotechnology and participation in one of the Department's research projects.

### Biological Science

#### Plant Science

43.111 Flowering Plants

Prerequisites: 17.031 and 17.041.

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 environment. Introduction to taxonomy and identification of major Australian plant families. A short field excursion is part of the subject.

43.112 Taxonomy and Systematics

Prerequisite: 43.111.

The assessment, analysis and presentation of data for classifying organisms both at the specific and supra-specific level.

43.121 Environmental Physiology

Prerequisites: 17.031, 17.041, 2.121 and 2.131, or 2.141.

How plants function in relation to the constraints imposed on them by soil and atmospheric environments. Includes: germination, growth and development, particularly photosynthesis, respiration, inorganic nutrition, water relations, transport processes and reproductive physiology. Important practical applications of various physiological mechanisms.

43.142 Environmental Botany

Prerequisites: 17.031 and 17.041.

The soil and atmospheric environments in which plants live and a study of the interaction of plants with their environment. Energy and mass transfer. Emphasis is placed on the role of environmental science in food production.

### Animal Science

45.101 Biometry


Statistical methods and their application to biological data, including introduction to probability; the binomial, Poisson, normal distributions; student's t, F and variance ratio tests of significance based on the above distributions; the analysis of variance of orthogonal and some non-orthogonal designs; linear regression and correlation. Non-linear and multiple regression. Introductory factorial analysis. Introduction to experimental design. Non-parametric statistics, including tests based on ?, the Kruskal-Wallis test, Fisher's exact probability test and rank correlation methods. Introduction to programming in BASIC.

45.121 Evolutionary Theory

Prerequisites: 17.031, 17.041.

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

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

Prerequisites: 17.041 and 10.001 or 10.011 or both 10.021B and 10.021C.

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 Biology of Invertebrates

Prerequisites: 17.031, 17.041.

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
Prerequisites: 17.031 and 17.021, or 17.041.
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
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 humans. Field excursions as arranged.

45.422 Economic Zoology
Prerequisite: 45.201 or 45.402.
A study of the biology, ecology and control of vertebrate and invertebrate animals which harm humans and their possessions. Human and domestic animal parasitology, pests on plants, diseases caused or spread by animals, chemicals, biological and physical control, and side effects.

44.121 Microbiology 1
Prerequisites: 44.101 and 41.101 or 2.003J.
The balanced structure of this unit makes it suitable for students majoring in microbiology and also for students who wish to enlarge their knowledge and skills in microbiology beyond those obtained in 44.101 Introductory Microbiology or equivalent units at other institutions.

54.1003 Australian Political Institutions
Prerequisite: 45.201 or 45.402.
The nature and history of Australian political institutions in depth. The Australian constitution and federal structure and the role of the High Court in helping determine the nature of the power relationships in Australian politics. The political parties, their history, successes and failures, strengths and weaknesses both in and out of government. The formal institutions of government: parliament, cabinet, the bureaucracy and both Labor and Liberal prime ministers. Elections and voting in Australia and pressure groups.

54.1004 Government in the Modern World
A. Chan, A.C. Palfreeman
Excluded: 54.1001.
The development, nature and forms of government in the modern world. Particular attention is paid to the major conceptual tools of political analysis with emphasis on a comparative approach to the study of government and case studies drawn from Australia and the industrialized and developing areas. An underlying theme is the management of conflict and the establishment of order in the various systems examined.
54.1005 A History of Political Thought    S2 3CCH C6
C. Condren

An introduction to Western political theory through the study of four major texts taken from three distinctly different political civilisations. Each text is studied against its social and intellectual background and in the context of the political crises to which it was addressed. The main themes of the lectures concern the relationship between political theory and practice and that between language and political awareness.


54.2008 Public Policy Making    S2 3CCH C6
E. Thompson

Prerequisite: 12 Level I credit points in Political Science.

The problems of administering government and the problems of decision making. Models of decision-making are discussed, as are problems in implementation. Areas of public policy in Australia, such as poverty and education.

54.1006 The Australian Political System    S1 3CCH C6
R. Lucy

Basic concepts in political science such as power, influence and authority. Models of the Australian political system. The subsequent examination of the Australian political system is designed to illustrate these concepts and to test these models. The Australian political system is understood as the formal governmental institutions, political parties, and political culture. Australian political issues are studied to illustrate the Australian political culture.

54.1007 The Politics of Development    S2 3CCH C6
R. Lim

Excluded: 54.1001.

The history of Australia's relations with Asia. Australia's place in the postwar network of US alliances and the impact of this on relations with regional countries, especially China. The development of ASEAN and Australia's relations with it, with particular emphasis on Indonesia. The economic relationship with Japan and China and proposals for an Asian Pacific community. The debate about aid policy.

54.1008 Politics of Soviet-Type Systems    S1 3CCH C6
S. Fortescue

Excluded: 54.1001.

Examines political concepts and phenomena in Soviet-type systems, with the emphasis on Eastern Europe. Includes legitimacy and authority, economic reform and political pluralism, the party in communist systems, political participation, and others. The approach is strongly comparative, with an effort being made to discern and explain differences within the Eastern bloc, and between that bloc and the Western and developing worlds.
Graduate Study

Chemistry

2.251G Toxicology, Occupational and Public Health

F L1T3

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 and analysis, trace metal determination and experiments on the animal metabolism of toxic substances.

2.271G Chemistry and Analysis of Foods

F L1T3

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. 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.

Electrical Engineering and Computer Science

6.070G Digital Image Processing Systems

C3

Excluded: 6.476G.

The fundamentals of digital image processing with topics selected from the following: Visual perception and the image model, transforms, enhancement, sharpening and smoothing, restoration, encoding, segmentation, reconstruction and images from projections and tomography, satellite imaging and imaging in remote sensing; image processing hardware and systems; picture processing; measurement and inspection.

97.580G Image Analysis in Remote Sensing

Prerequisite: 10.361 or equivalent.

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.

97.581G Microwave Remote Sensing

C

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave imagery data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

Civil Engineering

8.402G Transport, Environment, Community

F C


8.403G Theory of Land Use/Transport Interaction

S1 C

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equations of state (function behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, mode, assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional national).

8.413G Transport Economics

S2 C

Cost and price analysis for 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 models.

8.701G Economic Decision Making in Civil Engineering

SS C

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.
Graduate Servicing Subject Descriptions

8.703G Optimization Techniques in Civil Engineering SS C3
Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.776G Rock Mechanics SS C3

8.777G Numerical Methods in Geomechanics SS C3
Fundamentals of finite element and boundary element methods; application to practical geotechnical design and case studies; deformation and flow problems; linear and non-linear analysis; application to underground opening, stability of slopes, foundations, mining excavation; seepage and consolidation soil-structure interaction problems; earth pressures, retaining walls and buried pipes, thermal stress analysis.

8.833G Free Surface Flow SS C3
Theory of waterflow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

8.842G Groundwater Hydrology SS 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 SS 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 SS 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 SS C3
Principles of the optimal design and operation of multiple purpose, multiple component, water resource system; evaluation of cost and benefits in complex and simple systems.

8.849G Irrigation SS 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 SS C3
Characteristics of drainage systems, steady and unsteady state drainage formulae, conformal transformation solutions, soil characteristics field measurement of hydraulic conductivity and soil water pressure, significance of unsaturated zone, practical aspects.

8.857G Sewage Treatment and Disposal SS C3
Application of processes and process variations used to improve the quality of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal.

8.857X Sewage Treatment and Disposal (external) S2 C3

8.860G Investigation of Groundwater SS C3
Resource issues, objectives and methods, aquifer systems, evaluation and extraction of groundwater, investigation and analysis, occurrence and extraction of groundwater, investigation and analysis, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources 1 SS C3
Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.864G Arid Zone Hydrology S1 L1½T1½ C3
Co-requisites: 8.837G, 8.838G.
Arid zone rainfall characteristics, data collection and instrumentation, run off 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 SS 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; measurement of flow rate, volume, quality. Engineering works: design, construction, operation and maintenance of work, including excavation 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.

8.870G Hydraulics and Design of Water and Wastewater Treatment Plants S2 C3
Co-requisites: 8.856G, 8.857G.
Application of hydraulic principles to flows within treatment plants. Selection and integration of unit processes required for
water and wastewater treatment, plant layout, plant design including hydraulic profiles, the influence of flow and load variability, instrumentation and control strategies.

8.872G Management of Wastes S2 L2T1 C3
8.872X Management of Wastes (external) S1 C3
Management and control strategies in waste management, legal requirements, local and overseas legislation, case studies of waste management.

8.873G Waste and Wastewater Analysis and Environmental Requirements S1 L1½T1½C3
8.873X Waste and Wastewater Analysis and Environmental Requirements (external) S1 C3
Principles of analytical methods used in chemical analysis of wastes and wastewaters, sampling schemes, statistical evaluation of data, environmental requirements to prevent pollution.

8.874G Waste Management Science S1 L2T1C3
8.874X Waste Management Science (external) S1 C3
Aspects of chemistry, biology and geology relevant to waste management, equilibrium and kinetic approaches, cell structure and metabolisms, formation and classification of rocks and soils.

8.875G Hydrological Processes S1 L2 T1 C3
Measurements and variations of meteorological processes. Conditions for precipitation. Definition, forms, types and measurement of precipitation.

The evaporation process. Plant water dynamics. Methods of estimating evaporation and transpiration at different space and time scales. Management of evaporation and transpiration.


General description of the runoff process. Horton runoff, saturated surface flow, throughflow, partial area runoff, variable source areas, occurrence of different processes. Effects of depression storage, topography and subsurface features such as macropores and soil horizons on the nature of processes and their space-time distribution. Catchment storage, channel transmission losses.

Groundwater recharge by percolation through vadose zone and by transmission loss from streams. Artificial recharge. Groundwater discharge through stream base flow and transpiration of phreatophytes.

Effects of land use on precipitation, interception, infiltration, evapotranspiration. Resulting effects on yield, flood runoff, water quality, surface salting and sediment production.

8.877G Flood Design 1 SS C3
Introduction to flood estimation, frequency analysis of hydrological data, design rainfall data, hydrograph analysis, storm rainfall-runoff relations, design flood estimation for small to medium sized catchments including the rational method, introduction to urban drainage design.

8.878G Flood Design 2 SS C3
Introductory flood routing, loss rates, linear and nonlinear response, unit hydrographs, runoff routing, choice of method of flood estimation, urban drainage design.

8.879G Flood Design 3 SS C3
Flood frequency analysis, river flood routing, catchment characteristics, estimation of extreme floods, synthetic unit hydrographs, design hydrograph methods, application of runoff routing models.

8.880G Groundwater Modelling S1 L1½ T1½ C3

Surveying

29.101G Aspects of Electromagnetic Distance Measurement SS L2T1 C3

29.102G Characteristics of Optical Surveying Instrumentation SS L2T1 C3
Sources of error in modern optical surveying instruments. Methods of testing and calibration. Observational techniques for reducing effects of errors. Developments in circle reading and level sensing systems. Design of instrument testing facilities.
29.103G Precise Engineering Surveys SS L2T1 C3
Techniques and instrumentation for precise surveys. Applications in industry and engineering; deformation and settlement surveys, surveys for large constructions, optical tooling, special measurement problems.

29.106G Special Topic in Surveying A C3
A special subject to be lectured on by visiting professors or other visiting staff.

29.107G Special Topic in Surveying B C3
A special subject taken by an individual student or a small group of students by private study in conjunction with tutorial sessions with the member(s) of staff in charge of the subject.

29.151G Adjustment of Control Surveys SS L2T1 C3

29.210G Satellite Surveying SS L2T1 C3
Concepts of satellite surveying: nomenclature, TRANSIT system, GPS for point and relative positioning, vertical control. Surveying with GPS: planning a survey, field and office procedures, case studies. Considerations for high-precision applications: aspects of satellite geodesy, modelling the observable, dual-frequency observations, orbit determination, short-arc techniques.

29.211G Introduction to Geodesy S1 L2 T1 C3

29.212G Doppler Positioning SS L2T1 C3

29.213G Physical Meteorology S2 L2T1 C3

29.530G Analytical Photogrammetry SS L2T1 C3
Fundamental relationships, image and object space. Interior orientation, deviations from collinearity, use of reseau. General orientation of one and two images by collinearity and coplanarity conditions. Calibration of metric and non-metric cameras. Principles of analytical plotters, software design. Special applications of photogrammetry.

29.531G Photogrammetric Block Adjustment SS L2T1 C3

29.532G Computer-Assisted Mapping SS L2T1
Introduction to principles of computer-assisted mapping. Sources of data, ground survey maps, images. Collection and editing of feature coded digital terrain data, points, lines and areas. Digital elevation models, acquisition and interpolation, breaklines, contouring. Accuracy of heights from digital elevation models. Design of mapping programs based on computer-assisted techniques.

29.600G Principles of Remote Sensing S1 L2T1 C3

29.602G Remote Sensing Procedures S2 L2T1 C3
Review of atmospheric correction procedures and application to multi-temporal Landsat MSS data. Review of image registration, enhancement and classification procedures with particular reference to multi-source remote sensing data sets. Analysis of techniques over a varied land use area. Land use change project and analysis using multi-source and multi-temporal remotely sensed imagery, including Landsat MSS, TM, SPOT and SAR.

29.603G Statutory Controls of Land Development SS L2T1 C3
Detailed examination of the subdivision and development process in N.S.W., with particular emphasis on the statutory procedures and controls at the local government level. The Local Government Appeals Tribunal and its major relevant decisions. Local Government and land development law. Case studies in land development.
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. Computerization 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. Application of Anc-Info LIS software.

29.605G Ground Investigations for Remote Sensing  S1 L2T1 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.

29.608G Cadastral Systems  SS L2T1 C3

29.909G Project  C9
29.918G Project Report  C18
29.936G Thesis  C36

Industrial Relations and Organizational Behaviour

Due to uncertainties in staffing, it is not possible for the Faculty of Commerce to give an assurance that all subjects in Organizational Behaviour listed in the handbook will be offered in future years.

30.935G Organization Behaviour  S1 L3
Relationships between individuals and organizations. Individual behaviour—personality, perception, motivation, learning, performance. Organizations as settings for individual behaviour—types of organization, work organizations. Interaction, groups and work groups. Organizational influences on work behavior. Structural factors and the design of work; reward systems; organizational cultures and social influences. The development of individual-organization relationships: participation, socialization, careers; conflict, stress and adaptation; organizational effectiveness.

30.958G Organizational Communications  S2 L3
Prerequisite: 30.935G or equivalent.
Communication is both an end and a means to an end for members of complex organizations. As an end, the pattern of inputting, processing and outputting of information is the network of interdependent relationships that we come to call an organization. Thus communication is organizing. As a means to an end, communication suggests the ways that govern the interaction of organizational members exchanging messages for the service of such outcomes as decision making, innovation, etc. Organizational communication therefore is the study of the flow of messages in an information network as well as the uses made of those messages by network participants for the overall attainment of organizational goals.

30.960G Technological Change and Organizational Participation  S1 L3
Prerequisite: 30.942G or 14.956G or their equivalent.
The complex relationships between technological change and organizational participation in societies using advanced technology, with particular reference to Australia, California, Japan, Germany and the Nordic nations. Key issues include: the relationship between technological change and sociotechnical systems, skill formation, organizational learning, industrial relations, humanization of work, organizational equity, participation, and power.

Town Planning

Graduate Study

36.945G The Organization of Town Planning
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.
Graduate Servicing Subject Descriptions

Graduate School of the Built Environment

39.908G Community Noise Control  S1 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.

Librarianship

55.815G Economics of Information Systems  S1

55.817G Information Storage and Retrieval Systems  F

55.823G Files and Database Systems  S1
File structures, database management systems and file interrogation systems in a text processing or bibliographical environment. Topics: relations, their mapping and normalization; access methods; data organization; independence, integrity and security; CODASYL databases, relational databases and query languages.
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 Faculty (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 Table of Courses (by faculty): Graduate Study in the Calendar.

For the statements Preparation and Submission of Project Reports and Theses for Higher Degrees and Policy with respect to the Use of Higher Degree Theses see the Calendar.

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**Graduate Diploma**

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*Faculty of Science

*Faculty of Biological Sciences

1. The degree of Doctor of Philosophy may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty or board (hereinafter referred to as the Committee) to a candidate who has made an original and significant contribution to knowledge.

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor with Honours from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment as a candidate for the degree.

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.
(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

(a) full-time attendance at the University;

(b) part-time attendance at the University.

(4) A full-time candidate shall be fully engaged in advanced study and research except that the candidate may undertake not more than five hours per week or a total of 240 hours per year on work which is not related to the advanced study and research.

(5) Before permitting a part-time candidate to enrol, the Committee shall be satisfied that the candidate can devote at least 20 hours each week to advanced study and research for the degree which (subject to (8)) shall include regular attendance at the school* on an average of at least one day per week for 48 weeks each year.

(6) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such assessment and perform such other work as may be prescribed by the Committee.

(7) The work shall be carried out under the direction of a supervisor appointed from the full-time academic members of the University staff.

(8) The work, other than field work, shall be carried out in a school* of the University except that the Committee:

(a) may permit a candidate to spend not more than eighteen months of the program in advanced study and research at another institution provided the work can be supervised in a manner satisfactory to the Committee;

(b) may permit a candidate to conduct the work at other places where special facilities not possessed by the University may be available provided the direction of the work remains wholly under the control of the supervisor;

(c) may permit a full-time candidate, who has been enrolled as a full-time candidate for at least six academic sessions, who has completed the research work and who is writing the thesis, to transfer to part-time candidature provided the candidate devotes at least 20 hours each week to work for the degree and maintains adequate contact with the supervisor.

(9) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school* in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(10) No candidate shall be awarded the degree until the lapse of six academic sessions from the date of enrolment in the case of a full-time candidate or eight academic sessions in the case of a part-time candidate. In the case of a candidate who has had previous research experience the committee may approve remission of up to two sessions for a full-time candidate and four sessions for a part-time candidate.

(11) A full-time candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. A part-time candidate for the degree shall present for examination not later than twelve academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the investigation.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3) The thesis shall comply with the following requirements:

(a) it must be an original and significant contribution to knowledge of the subject;

(b) the greater proportion of the work described must have been completed subsequent to enrolment for the degree;

(c) it must be written in English except that a candidate in the Faculty of Arts may be required by the Committee to write a thesis in an appropriate foreign language;

(d) it must reach a satisfactory standard of expression and presentation;

*Or department where a department is not within a school or schools or departments where the research is being undertaken in more than one school or department.
Graduate Study: Conditions for the Award of Higher Degrees

(e) it must consist of an account of the candidate's own research but in special cases work done conjointly with other persons may be accepted provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The 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 but may submit any work previously published whether or not such work is related to the thesis.

(5) 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 theses for higher degrees.

(6) 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.

5. (1) There shall be not fewer than three examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least two of whom shall be external to the University.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the thesis and shall recommend to the Committee that:

(a) the candidate be awarded the degree without further examination; or

(b) 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

(c) 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

(d) 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

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the results of any further examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate be permitted to resubmit the thesis after a further period of study and/or research.

6. A candidate shall pay such fees as may be determined from time to time by the Council.

1. The degree of Master of Applied Science or Master of Environmental Studies by formal course work may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

2. (1) A candidate for the degree shall:

(a) have been awarded an appropriate degree of Bachelor of four full-time years duration (or the part-time equivalent) from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee), or

*Or department where a department is not within a school.
Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Academic Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects including the submission of a report on a project, and pass such assessment as prescribed. The project shall be under the supervision of an academic staff member and shall be assessed by two examiners (for a major project).

(3) The progress of a candidate shall be reviewed at least once a year by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate and four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate, eight sessions for a part-time candidate, and ten sessions for an external candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME) and Master of Science (MSc)

1. The degree of Master of Engineering or Master of Science by research 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 original investigation.

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Academic Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

*Or department where a department is not within a school.
(a) full-time attendance at the University;
(b) part-time attendance at the University;
(c) external — not in regular attendance at the University and using research facilities external to the University.

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school* in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who has had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three 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.

(6) 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. (1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) 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:

(a) the candidate be awarded the degree without further examination; or
(b) 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
(c) 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
(d) 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
(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same

*Or department where a department is not within a school.
master of engineering, master of science, and master of surveying without supervision

Qualifications

1. The degree of Master of Engineering or Master of Science or Master of Surveying without supervision 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 original investigation.

2. A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales with at least three years relevant standing in the case of Honours graduates and four years relevant standing in the case of Pass graduates, and at a level acceptable to the Committee.

3. An application to enrol as a candidate for the degree without supervision shall be made on the prescribed form which shall be lodged with the Academic Registrar 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 or her own interest, seek at an early stage the advice of the appropriate head of school* with regard to the adequacy of the subject matter and its presentation for the degree. A synopsis of the work should be available.

4. (a) A candidate shall submit a thesis embodying the results of the investigation.

   (2) The candidate shall give in writing to the Academic Registrar two months notice of intention to submit the thesis.

   (3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

   (4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

   (5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of theses for higher degrees.

   (6) 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.

Examination

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

   (2) Before the thesis is submitted to the examiners the head of the school* in which the candidate is enrolled shall certify that it is prima facie worthy of examination.

   (3) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the thesis and shall recommend to the Committee that:

      (a) the candidate be awarded the degree without further examination; or

      (b) 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

*Or department where a department is not within a school.

6. A candidate shall pay such fees as may be determined from time to time by the Council.
(c) 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

(d) 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

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(4) If the performance at the further examination recommended under (3)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(5) The Committee shall, after consideration of the examiners' reports and the results of any further examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

6. A candidate shall pay such fees as may be determined from time to time by the Council.

See Master of Applied Science above.

See Master of Environmental Studies (MEnvStudles) above.

See Master of Engineering above.

See Master of Engineering without supervision above.

1. A Graduate Diploma may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

2. (1) A candidate for the diploma shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee).

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the diploma.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribed, before permitting enrolment.

3. (1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Academic Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.
(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Fees 4. A candidate shall pay such fees as may be determined from time to time by the Council.
Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. Each faculty handbook contains in its Scholarships and Prizes section the scholarships and prizes available with that faculty. The General Information section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

Listed below is an outline only of a number of scholarships available to students. 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.

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td></td>
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</tr>
<tr>
<td>Bursary Endowment Board*</td>
<td>$200 pa</td>
<td>Minimum period of approved degree/combined degree course</td>
<td>Merit in HSC and total family income not exceeding $6000</td>
</tr>
<tr>
<td>Sam Cracknell Memorial</td>
<td>Up to $3000 pa payable in fortnightly instalments.</td>
<td>1 year</td>
<td>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.</td>
</tr>
</tbody>
</table>

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060, immediately after sitting for HSC.
### Undergraduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
<th>Conditions</th>
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<tbody>
<tr>
<td><strong>General (continued)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Girls Realm Guild</td>
<td>Up to $1500 pa</td>
<td>1 year renewable</td>
<td>Available only to female students under 35 years of age who are permanent residents of Australia enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need.</td>
</tr>
<tr>
<td>W.S. and L. B. Robinson**</td>
<td>Up to $4200 pa</td>
<td>1 year renewable</td>
<td>Available only to students who have completed their schooling in Broken Hill or whose parents reside in Broken Hill; for a course related to the mining industry. Includes courses in mining engineering, geology, electrical and mechanical engineering, metallurgical process engineering, chemical engineering and science.</td>
</tr>
<tr>
<td>Universities Credit Union</td>
<td>$500 pa</td>
<td>1 year with the possibility of renewal</td>
<td>Prior completion of at least 1 year of any undergraduate degree course. Eligibility limited to members of the Universities Credit Union Ltd of more than one year's standing or members of the family of such members.</td>
</tr>
</tbody>
</table>

**Applications close 30 September each year.**

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### Applied Science

### Applied Bioscience

### Food Science and Technology

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca-Cola Export Corporation</td>
<td>Up to $1500 pa</td>
<td>1 year renewable</td>
<td>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.</td>
</tr>
<tr>
<td>George Weston Foods Ltd</td>
<td>Up to $4000 over 4 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goodman Fielder</td>
<td>Up to $500 pa</td>
<td>1 year renewable</td>
<td>Permanent residence in Australia. Eligible for admission to Year 2, 3 or 4 of course (three available).</td>
</tr>
<tr>
<td>Food Technology Association</td>
<td>$600 pa</td>
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</table>
### Undergraduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
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<tbody>
<tr>
<td><strong>Applied Science (continued)</strong></td>
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<td></td>
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</tr>
<tr>
<td><strong>Food Science and Technology</strong></td>
<td></td>
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</tr>
<tr>
<td>Coca-Cola Export Corporation</td>
<td>Up to $1500 pa</td>
<td>1 year renewable for the duration of the course subject to satisfactory progress</td>
<td></td>
</tr>
<tr>
<td>George Weston Foods Ltd</td>
<td>Up to $4000 over 4 years</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Goodman Fielder</td>
<td>Up to $500 pa</td>
<td>1 year renewable</td>
<td>Permanent residence in Australia. Eligible for admission to Year 2, 3 or 4 of course (three available).</td>
</tr>
<tr>
<td>Food Technology Association</td>
<td>$600 pa</td>
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</tr>
<tr>
<td><strong>Chemical Engineering and Industrial Chemistry</strong></td>
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<tr>
<td>Bridge Oil Ltd</td>
<td>Up to $5000 pa</td>
<td></td>
<td>Permanent residence in Australia living in Queensland and must have completed the first two years of any accredited engineering program in that state</td>
</tr>
<tr>
<td>Dow Chemical (Australia)</td>
<td>Up to $1000 pa</td>
<td></td>
<td>Permanent residence in Australia and eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering</td>
</tr>
<tr>
<td>Goodman Fielder</td>
<td>Up to $1000 pa</td>
<td>1 year renewable for the duration of the course subject to satisfactory progress</td>
<td></td>
</tr>
<tr>
<td>ICI Australia Operations Ltd</td>
<td>Up to $1000 pa</td>
<td></td>
<td>Permanent residence in Australia and eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering or Industrial Chemistry</td>
</tr>
<tr>
<td>Shell Refining (Australia) Pty Ltd</td>
<td>Up to $1500 pa</td>
<td></td>
<td>Eligibility for admission to Year 4 of the full-time degree course in Chemical Engineering</td>
</tr>
<tr>
<td>Society of Petroleum Engineers Pty Ltd</td>
<td>Up to $2500 pa</td>
<td></td>
<td>Permanent residence in Australia living in specified state and must have completed the first two years of any accredited engineering program in that state</td>
</tr>
<tr>
<td><strong>Fibre Science and Technology</strong></td>
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<tr>
<td><strong>Textile Technology</strong></td>
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</tr>
<tr>
<td>Bonds Industries Ltd</td>
<td>$2477 pa</td>
<td></td>
<td>Permanent residence in Australia and eligibility for admission to the full-time degree course in Textile Technology</td>
</tr>
<tr>
<td>Bradmill Textiles Ltd</td>
<td>Up to $3000 pa</td>
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<tr>
<td>Bruck (Australia) Limited</td>
<td>$3821 or $2477 pa</td>
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<tr>
<td>Fibremakers Division of ICI Australia Operations Pty Ltd</td>
<td>$3821 or $2477 pa</td>
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<tr>
<td>Reckitt's Toiletries International</td>
<td>Up to $1500 pa</td>
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<tr>
<td>Textile Council of Australia</td>
<td>$3821 or $2477 pa</td>
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<tr>
<td>Webco</td>
<td>$500 pa</td>
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</table>
### Undergraduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
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<tbody>
<tr>
<td><strong>Applied Science (continued)</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Wool and Animal Science</strong></td>
<td></td>
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<tr>
<td>National Australia Bank</td>
<td>Up to $1000 pa</td>
<td>1 year renewable for the duration of the course, subject to satisfactory progress</td>
<td>Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences</td>
</tr>
<tr>
<td>Merck, Sharp and Dohme</td>
<td>Up to $1000 pa</td>
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<tr>
<td><strong>Materials Science and Engineering</strong></td>
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<tr>
<td><strong>Materials</strong></td>
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</tr>
<tr>
<td>Australian Ceramic Society</td>
<td>Up to $300 pa</td>
<td>1 year renewable for the duration of the course subject to satisfactory progress</td>
<td>Permanent residence in Australia and eligibility for admission to Year 1 or Year 2 of the full-time degree course in Ceramic Engineering</td>
</tr>
<tr>
<td>The Brick Manufacturer's Association of New South Wales</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Caroma Industries Ltd</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Ceramco Limited</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Ferro Corporation</td>
<td>Up to $600 pa</td>
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<tr>
<td>Fowlerware</td>
<td>Up to $500 pa</td>
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<tr>
<td>Monier Limited</td>
<td>Up to $1000 pa</td>
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<tr>
<td>North Sydney Brick and Tile Co Ltd</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Plessey Australia Pty Ltd</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Swan Resources Ltd</td>
<td>Up to $1000 pa</td>
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<tr>
<td>The Thomson Family</td>
<td>Up to $1000 pa</td>
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<tr>
<td>Zacuba Pty Ltd</td>
<td>Up to $1500 pa</td>
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<tr>
<td><strong>Metallurgy</strong></td>
<td></td>
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<tr>
<td>Sandvik Australia Pty Ltd</td>
<td>Up to $1250 pa</td>
<td>1 year renewable for the duration of the course, subject to satisfactory progress</td>
<td>Permanent residence in Australia and eligibility for admission to Year 1 or Year 2 of the full-time degree course in Metallurgy or Metallurgical Process Engineering</td>
</tr>
<tr>
<td>Sir Rupert Myers</td>
<td>Up to $1500 pa</td>
<td></td>
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</tr>
<tr>
<td>Industrial Sponsors Program</td>
<td>Up to $1500 pa</td>
<td></td>
<td>Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering</td>
</tr>
</tbody>
</table>
Undergraduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
<th>Conditions</th>
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<tbody>
<tr>
<td><strong>Applied Science (continued)</strong></td>
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<tr>
<td><strong>Mines</strong></td>
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<tr>
<td><strong>Applied Geology</strong></td>
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</tr>
<tr>
<td>BP Coal Australia</td>
<td>Up to $500 pa</td>
<td>1 year renewable for the duration of the course, subject to satisfactory progress</td>
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</tr>
<tr>
<td><strong>Mining Engineering</strong></td>
<td></td>
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</tr>
<tr>
<td>Stan Sawyer Memorial Scholarship to Coal Mining Students</td>
<td>Up to $200 pa</td>
<td>Eligibility for admission to Year 3 or Year 4 of the full-time degree course in Mining Engineering</td>
<td></td>
</tr>
<tr>
<td><strong>School of Mines</strong></td>
<td></td>
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</tr>
<tr>
<td>Joint Coal Board Scholarship</td>
<td>$500</td>
<td>1 year</td>
<td></td>
</tr>
<tr>
<td>Enrolled in Year 4 of Geology, Mineral Engineering or Mining Engineering course. Selection is based on academic merit.</td>
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</tbody>
</table>

Graduate Scholarships

Application forms and further information are available from the Student Enquiry Counter, located on the Ground Floor of the Chancellery unless an alternative contact address is provided. Information is also available on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.


Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from: Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

Where possible, the scholarships are listed in order of faculty.

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
<th>Conditions</th>
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</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
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</tr>
<tr>
<td>University Postgraduate Research Scholarships</td>
<td>Living allowance of $7600 pa. Other allowances may also be paid.</td>
<td>1-2 years for a Masters and 3-4 years for a PhD degree</td>
<td>Applicants must be honours graduates (or equivalent). Applications to Dean of relevant Faculty.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Applicants must be honours graduates (or equivalent) or scholars who will graduate with honours in current academic year, and who are domiciled in Australia. Applications to the Academic Registrar by 31 October.</td>
</tr>
<tr>
<td>Commonwealth Postgraduate Research Awards</td>
<td>Living allowance of $8882 pa. Other allowances may also be paid.</td>
<td>1-2 years, minimum duration of course</td>
<td>Applicants must be graduates or scholars who will graduate in current academic year, and who have not previously held a Commonwealth Post-graduate Award. Preference is given to applicants with employment experience. Applications to the Academic Registrar by 30 September.</td>
</tr>
</tbody>
</table>

*Available for reference in the University Library.*
## Graduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Scholarship and Details</th>
<th>Value</th>
<th>Year(s) of Tenure</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian American Educational Foundation Fulbright Award</td>
<td>Travel expenses and $A2000 as establishment allowance.</td>
<td>1 year, renewable</td>
<td>Applicants must be graduates who are domiciled in Australia and wish to undertake research or study for a higher degree in America. Applications close 30 September with The Secretary, DEET, AAEF Travel Grants, PO Box 826, Woden ACT 2606.</td>
</tr>
<tr>
<td>Australian Federation of University Women</td>
<td>Amount varies, depending on award</td>
<td>Up to 1 year</td>
<td>Applicants must be female graduates who are members of the Australian Federation of University Women</td>
</tr>
<tr>
<td>Commonwealth Scholarship and Fellowship Plan</td>
<td>Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.</td>
<td>Usually 2 years, sometimes 3</td>
<td>Applicants must be graduates who are Australian citizens and who are not older than 35 years of age. Tenable in Commonwealth countries other than Australia. Applications close with the Academic Registrar in September or October each year.</td>
</tr>
<tr>
<td>The English-Speaking Union (NSW Branch)</td>
<td>$5000</td>
<td>1 year</td>
<td>Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia. Applications close mid-April with The Secretary, Ground Floor, Sydney School of Arts, 275c Pitt Street, Sydney NSW 2000.</td>
</tr>
<tr>
<td>Frank Knox Memorial Fellowships tenable at Harvard University</td>
<td>Stipend of US$7000 pa plus tuition fees</td>
<td>Up to 2 years</td>
<td>Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian university. Applications close with the Academic Registrar mid-October.</td>
</tr>
<tr>
<td>Robert Gordon Menzies Scholarship to Harvard</td>
<td>Up to $US 15,000</td>
<td>1 year</td>
<td>Tenable at Harvard University. Applicants must be Australian citizens and graduates of an Australian tertiary institution. Applications close 31 December with the Registrar, A.N.U., GPO Box 4, Canberra ACT 2601.</td>
</tr>
<tr>
<td>Gowne Scholarship Trust Fund</td>
<td>$4000 pa. Under special circumstances this may be increased.</td>
<td>2 years</td>
<td>Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War. Applications close with the Academic Registrar by 31 October.</td>
</tr>
<tr>
<td>Harkness Fellowships of the Commonwealth Fund of New York</td>
<td>Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA</td>
<td>12 to 21 months</td>
<td>Candidates must be Australian citizens and 1. Either members of the Commonwealth or a State Public Service or semi-government Authority. 2. Either 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 29 August with the Academic Registrar. Forms available from Mr J Larkin, Bureau of Agriculture and Resource Economics, GPO Box 1563, Canberra ACT 2601.</td>
</tr>
</tbody>
</table>
Graduate Scholarships (continued)

<table>
<thead>
<tr>
<th>Donor</th>
<th>Value</th>
<th>Year/s of Tenure</th>
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<tbody>
<tr>
<td>The Packer, Shell and Barclays Scholarships to Cambridge University</td>
<td>Living and travel allowances, tuition expenses.</td>
<td>1-3 years</td>
<td>Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications close 15 October with The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 ITZ England.</td>
</tr>
<tr>
<td>The Rhodes Scholarship to Oxford University</td>
<td>Approximately L3600 stg pa</td>
<td>2 years, may be extended for a third year</td>
<td>Unmarried Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close in August each year with The Secretary, University of Sydney, NSW 2006.</td>
</tr>
</tbody>
</table>

Applied Science

<table>
<thead>
<tr>
<th>Pig Research Council Study/Training Awards</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Wool Corporation Postgraduate Scholarships</td>
<td>$19,923 pa (taxable)</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Australian Meat and Live-stock Research and Development Corporation</td>
<td>$8882 pa</td>
<td>1-3 years, varies with course.</td>
<td>Awarded for graduate study of the industry leading to the award of a diploma, or Masters of PhD degree. Tenable in Australia or overseas. Applications close 31 July with the AMLR&amp;D Corporation, PO Box A498, Sydney South NSW 2000.</td>
</tr>
<tr>
<td>Water Industry Research Award</td>
<td>$17,764 pa</td>
<td>2-4 years</td>
<td>Applications close with the Academic Registrar 10 January.</td>
</tr>
</tbody>
</table>

Prizes

Undergraduate University Prizes

The following table summarizes the undergraduate prizes awarded by the University. 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.
### Undergraduate University Prizes

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Values</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney Technical College Union Award</td>
<td>300.00</td>
<td>Leadership in the development of student affairs, and academic proficiency throughout the course</td>
</tr>
<tr>
<td>University of New South Wales Alumni</td>
<td>Statuette</td>
<td>Achievement for community benefit — students in their final or graduating year</td>
</tr>
</tbody>
</table>

### Faculties of Applied Science and Engineering

| Institution of Engineers, Australia | Medal and 200.00 | 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 Mines

#### Department of Applied Geology

<table>
<thead>
<tr>
<th>Crae Mapping Prize</th>
<th>250.00</th>
<th>Best performance in 25.312 Earth Environments 2 — Geological Field Mapping Tutorial in the Bachelor of Science degree course</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.C. Loughnan</td>
<td>340.00</td>
<td>Most outstanding student in Year 3 of the Geology course in the Bachelor of Science degree course.</td>
</tr>
</tbody>
</table>

### School of Applied Bioscience

#### Department of Biotechnology

<table>
<thead>
<tr>
<th>Mauri Foods</th>
<th>175.00</th>
<th>Best result in 42.101 Introduction to Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>175.00</td>
<td>Best result in one of the Level 3 Biotechnology subjects. 42.102A Biotechnology A, 42.102B Biotechnology B, 42.102C Microbial Genetics in the Bachelor of Science degree course</td>
</tr>
<tr>
<td></td>
<td>175.00</td>
<td>Best result in the Biotechnology honours degree program</td>
</tr>
</tbody>
</table>

#### Department of Food Science

| Cottees General Foods | 120.00 | Best performance in 38.141 Food Regulation and Control in the Bachelor of Science in Food Technology course |
## Undergraduate University Prizes (continued)

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestle Australia Pty Ltd</td>
<td>200.00</td>
<td>Best performance in 38.140 Food Technology project in the Bachelor of Science degree course in Food Technology</td>
</tr>
<tr>
<td>Wilfred B. S. Bishop</td>
<td>75.00</td>
<td>General proficiency throughout Bachelor of Science degree course in Food Technology by a student who has made a significant contribution to staff and student activities</td>
</tr>
</tbody>
</table>

## School of Chemical Engineering and Industrial Chemistry

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott Laboratories Pty Ltd</td>
<td>150.00</td>
<td>Best performance in Bachelor of Engineering degree course in Chemical Engineering — Year 4</td>
</tr>
<tr>
<td>Australasian Corrosion Association (NSW)</td>
<td>150.00</td>
<td>Best performance in 48.121 Corrosion in the Chemical Industry</td>
</tr>
<tr>
<td>AGL Sydney Limited</td>
<td>200.00</td>
<td>Subject selected by Head of School</td>
</tr>
<tr>
<td>Australian Paper Manufacturers Ltd</td>
<td>150.00</td>
<td>48.163 Instrumentation and Process Control in Industrial Chemistry</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
<td>48.163. Instrumentation and Process Control in Chemical Engineering</td>
</tr>
<tr>
<td>Chemical Technology Society</td>
<td>25.00</td>
<td>Best graduate in Bachelor of Science degree in Industrial Chemistry</td>
</tr>
<tr>
<td></td>
<td>25.00</td>
<td>Best graduate in Bachelor of Science degree course in Industrial Chemistry, Years 1 and 2 or Stages 1 to 4</td>
</tr>
<tr>
<td>CSR Limited</td>
<td>50.00</td>
<td>Subject within the discipline of Industrial Chemistry, selected by Head of School</td>
</tr>
<tr>
<td>Esso Australia Ltd</td>
<td>200.00</td>
<td>Best performance in Year 2 Chemical Engineering</td>
</tr>
<tr>
<td>Institution of Chemical Engineers</td>
<td>100.00</td>
<td>Best result for the thesis in the final year, or equivalent part time stage, of the Bachelor of Engineering degree course</td>
</tr>
<tr>
<td>Shell</td>
<td>100.00</td>
<td>General proficiency in Year 2 or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td>General proficiency in Year 3 or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td>General proficiency in Year 4 or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td>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</td>
</tr>
</tbody>
</table>
Undergraduate University Prizes (continued)

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon-Carves Australia</td>
<td>100.00</td>
<td>48.135 Thermodynamics</td>
</tr>
<tr>
<td>Stauffer Australia Limited</td>
<td>100.00</td>
<td>Subject selected by Head of School</td>
</tr>
<tr>
<td>Western Mining Corporation Ltd</td>
<td>150.00</td>
<td>48.036 Chemical Engineering Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
<td>48.044 Chemical Engineering Laboratory 2</td>
</tr>
<tr>
<td>Australian Institute of Energy</td>
<td>50.00</td>
<td>For a fuel subject or allied subject project</td>
</tr>
<tr>
<td>Fuel Technology Staff</td>
<td>200.00</td>
<td>Best performance in Year 3 or 4 Fuel Technology subject in the Bachelor of Engineering degree course in Chemical Engineering</td>
</tr>
<tr>
<td>Shell</td>
<td>200.00</td>
<td>Subject selected by Head of School</td>
</tr>
</tbody>
</table>

School of Fibre Science and Technology

Department of Textile Technology

<table>
<thead>
<tr>
<th>Name</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. B. Speakman</td>
<td>50.00</td>
<td>Undergraduate thesis</td>
</tr>
<tr>
<td>Textile Institute</td>
<td></td>
<td>Best performance in 13.113 Textile Technology 3 in the Bachelor of Science in Textile Technology degree course</td>
</tr>
<tr>
<td>R. J. Webster</td>
<td>250.00</td>
<td>General proficiency throughout the Bachelor of Science degree course in Textile Technology</td>
</tr>
</tbody>
</table>

Department of Wool and Animal Science

<table>
<thead>
<tr>
<th>Name</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayer Animal Health</td>
<td>120.00</td>
<td>General proficiency — Wool and Pastoral Sciences degree course, Year 2 and Year 3</td>
</tr>
<tr>
<td>Farmers Federation</td>
<td>150.000</td>
<td>Excellent academic attainment by a graduating student</td>
</tr>
<tr>
<td>C. R. Luckock</td>
<td></td>
<td>Meat Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A book or a voucher to the value of 60.00 payable to University Co-op Bookshop Limited</td>
</tr>
<tr>
<td>Parkes Wool Promotion Committee</td>
<td></td>
<td>Best performance in Practical Wool Studies in the Bachelor of Science degree in Wool and Pastoral Sciences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A shield held in the Department of Wool Science on which the successful student's name is engraved each year</td>
</tr>
<tr>
<td>P. R. McMahon Memorial</td>
<td>100.00</td>
<td>Excellence in Wool Science</td>
</tr>
</tbody>
</table>
### Undergraduate University Prizes (continued)

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>School of Geography</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Mabbutt Medal</td>
<td>Medal</td>
<td>Best performance in Fourth Year Project in Applied Geography by a student proceeding to Bachelor of Science</td>
</tr>
<tr>
<td>Jack Mabbutt Prize</td>
<td>150.00</td>
<td>Best performance by a third year student proceeding to Honours in Geography</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>School of Materials Science and Engineering</strong></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcan Australia Ltd</td>
<td>200.00</td>
<td>Subject selected by Head of School</td>
</tr>
<tr>
<td>Austral Crane</td>
<td>150.00</td>
<td></td>
</tr>
<tr>
<td>Australasian Corrosion Association (NSW Branch)</td>
<td>150.00</td>
<td>Best performance in 4.623B Metallurgical engineering by a Metallurgical Engineering student</td>
</tr>
<tr>
<td>Institute of Metals and Materials Australasia</td>
<td>100.00</td>
<td>Subject selected by Head of School</td>
</tr>
<tr>
<td>Australian Welding Institute</td>
<td>30.00</td>
<td>Best performance in the final year practical examination or an outstanding effort in Metallography</td>
</tr>
<tr>
<td>Book order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Broken Hill Proprietary Co Ltd</td>
<td>150.00</td>
<td>Best performance in the final year seminar class or, by a student who in the Head of School's opinion has contributed most to the corporate life of the School of Materials Science and Engineering</td>
</tr>
<tr>
<td>The Max Hatherly</td>
<td>275.00</td>
<td></td>
</tr>
<tr>
<td>The Hugh Muir</td>
<td>275.00</td>
<td></td>
</tr>
<tr>
<td>Western Mining Corporation Ltd</td>
<td>150.00</td>
<td>Best overall performance in Year 3 full-time (or its equivalent part-time) in Bachelor of Engineering (or Bachelor of Science (Technology)) degree course</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
<td>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</td>
</tr>
<tr>
<td>The Z.C. Mines</td>
<td>200.00</td>
<td>Subject selected by Head of School</td>
</tr>
</tbody>
</table>

### School of Mines

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Coal Board</td>
<td>200.00</td>
<td>Bachelor of Engineering degree course in Mining Engineering, Year 2</td>
</tr>
</tbody>
</table>
### Undergraduate University Prizes (continued)

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Mining Corporation Ltd</td>
<td>150.00</td>
<td>Best overall performance in final year of Bachelor of Engineering degree course</td>
</tr>
<tr>
<td>Western Mining Corporation Ltd</td>
<td>200.00</td>
<td>General proficiency throughout the Bachelor of Engineering degree course</td>
</tr>
<tr>
<td>Western Mining Corporation Ltd</td>
<td>150.00</td>
<td>Best overall performance in penultimate year of Bachelor of Engineering degree course</td>
</tr>
</tbody>
</table>

### Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

<table>
<thead>
<tr>
<th>Donor/Name of Prize</th>
<th>Value $</th>
<th>Awarded for</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Chemical Engineering and Industrial Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Clean Air Society of Australia and New Zealand</td>
<td>100.00</td>
<td>48.391G Atmospheric Pollution Control and 48.392G Practical Aspects of Air Pollution Measurement and Control</td>
</tr>
</tbody>
</table>

### School of Fibre Science and Technology

#### Department of Textile Technology

Malcolm Chaikin                                                                 200.00 and bronze medal
For the most outstanding thesis for the degree of Doctor of Philosophy in the Department of Textile Technology
The University of New South Wales Kensington Campus

Theatres
Biomedical Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Rex Vowels Theatre F17
Keith Burrows Theatre J14
Main Building (Physics) Theatrette 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 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 and Economics (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
Io Myers Studio D9
John Goodsell (Commerce and Economics) F20
Kanga's House Q14
Kensington Colleges C17 (Office)
Basser C18
Goldstein D16
Philip Baxter D14

Link B6
Maintenance Workshop B13
Materials Science and Engineering E8
Mathews F23
Mechanical and Industrial Engineering J17
Medicine (Administration) B27
Menzies Library E21
Morven Brown (Arts) C20
New College (Anglican) L6
Parade J12
NIDA D2
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 M7

General
Academic Staff Office C22
Accounting F20
Admissions C22
Adviser for Prospective Students F15
Anatomy C27
Applied Economic Research G14
Applied Geology F10
Applied Science (Faculty Office) F10
Architecture (including Faculty Office) H14
Arts (Faculty Office) C20
Audio Visual Unit F20
Australian Graduate School of Management G27
Banking and Finance F20
Biochemistry D26
Biological and Behavioural Sciences (Faculty Office) D26
Biomedical Engineering A28
Biomedical Library F23
Biotechnology D26
Bookshop G17
Building H14
Careers and Employment F15
Cashier's Office C22
Chaplains E15
Chemical Engineering and Industrial Chemistry F10
Chemistry E12
Child Care Centres N8, O14
Civil Engineering H20
Commerce and Economics (Faculty Office) F20
Community Medicine D26
Computing Services Department F21, D26
Continuing Education Support Unit F23
Counselling and Careers Service F15
Economics F20
Education G2
Education Testing Centre E15
Electrical Engineering and Computer Science G17
Energy Research, Development and Information Centre F10
Engineering (Faculty Office) K17
English C20
Ethics Committees Secretariat B8
Examinations C22
Fees Office C22
Food Science and Technology F10
French C20
General Staff Office C22
Geography K17
German Studies C20
Graduate Office and Alumni Centre E4
Graduate School of the Built Environment H14
Groundwater Management and Hydrogeology F10
Health Administration C22
History C20
Industrial Arts H14
Industrial Relations and Organizational Behaviour F20
Information Systems F20
Kanga's House O14
Kindergarten (House at Pooh Corner) N8
Landscape Architecture K15
Law (Faculty Office) F21
Law Library F21
Legal Studies and Taxation F20
Liberal and General Studies C20
Librarianship F23
Library E21
Lost Property C22
Marine Science D26
Marketing F20
Materials Science and Engineering E8
Mathematics F23
Mechanical and Industrial Engineering J17
Medical Education C27
Medicine (Faculty Office) B27
Microbiology D26
Mineral Processing and Extractive Metallurgy E8
Mining Engineering K15
Music B11
National Institute of Dramatic Art D2
Off-campus Housing C22
Optometry J12
Pathology C27
Patrol and Cleaning Services C22
Petroleum Engineering D12
Philosophy C20
Physics K15
Physiology and Pharmacology C27
Political Science C20
Printing Unit C22
Psychology F23
Public Affairs Unit C22
Publications Section C22
Remote Sensing K17
Russian Studies C20
Safety Science J17
Science and Mathematics Course Office D26
Science and Technology Studies C20
Social Work G2
Sociology C20
Spanish and Latin American Studies C20
Sport and Recreation Centre B6
Student Health E15
Student Records C22
Students' Union E4 and C21
Surveying K17
Tertiary Education Research Centre E15
Textile Technology G14
Theatre Studies B10
Town Planning K15
Union Shop (Upper Campus) D2
University Archives E21
University Press A28
University Union (Blockhouse) G6
Waste Management H20
WHO Regional Training Centre C27
Wool and Animal Science B8
This Handbook has been specifically 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 and Economics, Engineering, Law, Medicine, Professional Studies, Science (including Biological and Behavioural Sciences and the Board of Studies in Science and Mathematics), and the Australian Graduate School of Management (AGSM).

The Calendar and Handbooks, which vary in cost, are available from the Cashier's Office.