The University of New South Wales

Engineering

1985 Faculty Handbook

How to use this Handbook

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

General Information (pages 1-24) lists what you need to know about the University as a whole, introduces some of the services available and notes the most important rules and procedures. You should read this part in its entirety.

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

Faculty Information.

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

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

Information includes:

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

Graduate Study is about higher degrees.

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

Information included is as for **Undergraduate Study: Subject Descriptions,** above.

Conditions for the Award of Higher Degrees.

Scholarships and Prizes available at undergraduate and graduate level in the faculty.

Staff list.

For detailed reference, see the list of **Contents.**

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Engineering

1985 Faculty Handbook

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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 10 September 1984, but may be amended without notice by the University Council.

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General Information

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

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

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

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 697 2222 and ask for the extension. Alternatively you may dial 697 and then the extension number. This prefix should only be used when you are certain of the extension that you require as callers using 697 cannot be transferred to any other number.

Some people who can help you

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

The **Student Services** staff, located on the first floor of the Chancellery, will help those students who need advice and who have problems but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with general enquiries the staff is especially concerned with the problems of overseas, Aboriginal, and physically handicapped and disabled students. Enquire at Room 148E, phone 3114.

The **Assistant Registrar (Student Records and Scholarships — Undergraduate and Postgraduate)**, Mr Graham Mayne, is located on the ground floor of the Chancellery. For particular enquiries regarding illness and other matters affecting performance in examinations and assessment, graduation ceremonies, release of examination results and variations to enrolment programs, phone 3102 or 3097.

The **Senior Administrative Officer (Admissions)**, Mr John Beauchamp, is located on the ground floor of the Chancellery. General inquiries should be directed to 3095.

The **Senior Administrative Officer (Examinations)**, Mr John Grigg, is located on the ground floor of the Chancellery. Enquiries regarding examinations, including examination timetables and clash of examinations should be directed to 3088.

The **Adviser for Prospective Students**, Mrs Fay Lindsay, is located in the Chancellery and is available for personal interview. For an appointment phone 3113.

The **Careers and Employment Section** is located in Room LG5 in the Chancellery. Enquiries should be directed to 3122.

The **Off-campus Housing Service** is located in Room 148E in the Chancellery. For assistance in obtaining suitable accommodation phone 3116.

Student Loans enquiries should be directed to Room 148E in the Chancellery, phone 3115.

The **Student Health Unit** is located in Hut E15b at the foot of Basser Steps. The Director is Dr Geoffrey Hansen. For medical aid phone 5427, 5426 or 5425.

The **Student Counselling and Research Unit** is located at the foot of Basser Steps. Dr Pat Cleary is the Head of the Unit. For assistance with educational or vocational problems ring 5418 or 5422 for an appointment.

The **University Librarian** is Mr Allan Horton. Library enquiries should be directed to 2649.

The **Chaplaincy Centre** is located in Hut E15a at the foot of Basser Steps.

The **Students' Union** has two offices on campus. One is located at the back of the Library Lawn (between the Chancellery and the Morven Brown Building), where the SU President, Education Vice President, Education Officer, Clubs and Societies Secretary and Postgraduate Officer are available to discuss student problems. The other is on the second floor of the Squarehouse, where the Secretary/Treasurer, Women's Officer, Overseas Student Director, the full-time Solicitor, *Tharunka* and *Campuswide* provide information and student services.

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

Calendar of Dates

The Academic Year

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

Session 1 commences on the first Monday of March.

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Faculties other than Medicine

Session 1	4 March to 12 May
(14 weeks)	*May Recess: 13 May to 19 May*
	20 May to 16 June
	Midyear Recess: 17 June to 21 July
Examinations	18 June to 3 July
Session 2	22 July to 25 August
(14 weeks)	*August Recess: 26 August to 1 September*
	2 September to 3 November
	Study Recess: 4 November to 10 November
Examinations	11 November to 29 November

Faculty of Medicine

First and Second Years	As for other faculties	
Third and Fourth Years	Term 1 (10 weeks)	21 January to 31 March
	Term 2 (9 weeks)	9 April to 12 May
	May Recess:	*13 May to 19 May*
		20 May to 16 June
	Term 3 (9 weeks)	24 June to 25 August
	August Recess:	*26 August to 1 September*
	Term 4 (10 weeks)	2 September to 10 November
Fifth Year	Term 1 (8 weeks)	21 January to 17 March
	Term 2 (8 weeks)	25 March to 19 May
	Term 3 (8 weeks)	27 May to 21 July
	Term 4 (8 weeks)	29 July to 22 September
	Term 5 (8 weeks)	30 September to 24 November

January

Tuesday 1	Public Holiday — New Year's Day
Monday 7	List of graduands in Medicine for February Graduation Ceremony published in *The Sydney Morning Herald*
Friday 11	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 14	Last day for applications for review of results of assessment
Monday 28	Public Holiday — Australia Day

February

Friday 1	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 18	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses
Tuesday 26	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out the degree for which they have applied for any other reason

March

Monday 4	**Session 1 begins** — all courses except Medicine III, IV and V
Wednesday 6	List of graduands for April/May ceremonies and 1984 prizewinners published in *The Sydney Morning Herald*
Monday 11	Last day for notification of correction of details published in *The Sydney Morning Herald* on 6 March concerning April/May graduation ceremonies
Friday 15	Last day for acceptance of enrolment by new undergraduate students (late fee payable thereafter)
Friday 29	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable thereafter)

April

Friday 5	Good Friday — Public Holiday
Saturday 6	Easter Saturday — Public Holiday
Monday 8	Easter Monday — Public Holiday
Friday 19	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Thursday 25	Anzac Day — Public Holiday

May

Wednesday 1	*Confirmation of Enrolment* forms despatched to all students
Friday 10	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Monday 13	**May Recess begins**
Wednesday 15	Last day for undergraduate students completing requirements for degrees at the end of Session 1 to submit *Application for Admission to Degree* forms
Thursday 16	Publication of provisional timetable for June/July examinations
Sunday 19	**May Recess ends**
Friday 24	Last day for students to advise of examination clashes

June

Tuesday 4	Publication of timetable for June/July examinations
Monday 10	Queen's Birthday — Public Holiday
Sunday 16	**Session 1 ends**
Monday 17	**Midyear Recess begins**
Tuesday 18	Examinations begin

July

Wednesday 3	Examinations end
Monday 15	Assessment results mailed to students
Tuesday 16	Assessment results displayed on University noticeboards *To Friday 19 July:* Students to amend enrolment programs following receipt of June examination results
Sunday 21	**Midyear Recess ends**
Monday 22	**Session 2 begins**

August

Friday 2	Last day for students to discontinue without failure subjects which extend over the whole academic year
Monday 26	**August Recess begins**
Tuesday 27	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out the degree for which they have applied for any other reason

September

Sunday 1	**August Recess ends**
Wednesday 4	List of graduands for October graduation ceremonies published in *The Sydney Morning Herald*
Monday 9	Last day for notification of correction of details published in *The Sydney Morning Herald* on 4 September concerning October graduation ceremonies
Friday 13	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Monday 23	*Confirmation of Enrolment* forms despatched to all students
Monday 30	Last day to apply to UCAC for transfer to another tertiary institution in New South Wales

October

Wednesday 2	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Thursday 3	Publication of provisional examination timetable
Friday 4	Last day for applications from undergraduate students completing requirements for degrees at the end of Session 2 to submit applications for *Admission to Degree* forms
Monday 7	Eight Hour Day — Public Holiday
Friday 11	Last day for students to advise of examination timetable clashes
Thursday 24	Publication of timetable for November examinations.

November

Sunday 3	**Session 2 ends**
Monday 4	**Study Recess begins**
Sunday 10	**Study Recess ends**
Monday 11	Examinations begin
Friday 29	Examinations end

December

Monday 16	Assessment results mailed to students
Tuesday 17	Assessment results displayed on University noticeboards
Wednesday 25	Christmas Day — Public Holiday
Thursday 26	Boxing Day — Public Holiday

1986

Faculties other than Medicine and University College/Australian Defence Force Academy

Session 1 (14 weeks)	3 March to 11 May
	May Recess: 12 May to 18 May
	19 May to 15 June
	Midyear Recess: 16 June to 20 July
Examinations	17 June to 2 July
Session 2 (14 weeks)	21 July to 24 August
	August Recess: 25 August to 31 August
	1 September to 2 November
	Study Recess: 3 November to 9 November
Examinations	10 November to 28 November

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 20 January to 30 March Term 2 (9 weeks) 7 April to 11 May *May Recess: 12 May to 18 May* 19 May to 15 June Term 3 (9 weeks) 23 June to 24 August *August Recess: 25 August to 31 August* Term 4 (10 weeks) 1 September to 9 November
Fifth Year	Term 1 (8 weeks) 20 January to 16 March Term 2 (8 weeks) 24 March to 18 May Term 3 (8 weeks) 26 May to 20 July Term 4 (8 weeks) 28 July to 21 September Term 5 (8 weeks) 29 September to 23 November

Australian Graduate School of Management

Term 1 (10 weeks) 3 March to 9 May
Term 2 (10 weeks) 2 June to 8 August
Term 3 (10 weeks) 1 September to 7 November

University College/Australian Defence Force Academy

Session 1 (14 weeks)	3 March to 3 May *May Recess: 4 May to 18 May* 19 May to 20 June *Midyear Recess: 21 June to 13 July*
Examinations	23 June to 13 July
Session 2 (13 weeks)	14 July to 22 August *August Recess: 23 August to 7 September* 8 September to 24 October
Examinations	25 October to 15 November

January

Wednesday 1	Public Holiday (New Year)
Monday 6	List of graduands in Medicine for February Graduation Ceremony published in *The Sydney Morning Herald*
Friday 10	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 13	Last day for applications for review of results of annual examinations
Monday 27	Australia Day — Public Holiday

February

Monday 17	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses

March

Monday 3	Session 1 begins — all courses except Medicine III, IV and V
Friday 28 to Monday 31	Easter — Public Holiday

April

Friday 25	Anzac Day — Public Holiday

Organization of the University

The University of New South Wales was first incorporated by an Act of Parliament in 1949, under the name of the New South Wales University of Technology.

In 1984 the University had 18,036 students and over 3,800 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W.S. and L.B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

Arms of the University of New South Wales

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

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

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

The University Colours

The colours of the University are black and gold.

The Council

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

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

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

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

The Professorial Board

The Professorial Board is one of the two chief academic bodies within the University and includes all the professors from the various faculties, non-professorial Heads of Schools and Chairmen of Faculty, and several ex-officio and appointed members. It deliberates on all questions such as matriculation requirements, the content of courses, the arrangement of syllabuses, the appointment of examiners and the conditions for graduate degrees. Its recommendations on matters of major policy are presented to Council for its consideration and adoption.

The Faculties/Boards of Studies

The executive head of a faculty or board of studies is the dean, with the exception of the Australian Graduate School of Management, where the executive head is the director. Members of each faculty or board meet regularly to consider matters pertaining to their own areas of teaching and research, the result of their deliberations being then submitted to the Professorial Board.

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

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

The Schools

Subjects come under the control of the individual schools (eg the School of Chemistry, the School of Accountancy). The head of the school in which you are studying is the person in this academic structure with whom you will be most directly concerned.

Executive Officers

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

He is assisted in this task by a Deputy Vice-Chancellor and two Pro-Vice-Chancellors, together with the Deans and the two heads of the administrative divisions.

General Administration

In recent years the administration of general matters within the University has been mainly the concern of the Registrar's Division, the Bursar's Division and the Property Division.

In 1984 the University approved the reorganization of the general administrative structure into two groups each headed by a Deputy Principal.

Implementation of the new structure is now in progress and it is envisaged that a Deputy Principal (Administration) will be responsible for registrarial, property and staffing matters and a Deputy Principal (Planning and Information) will be responsible for planning information and analysis, finance and the provision of computing services.

Student Representation on Council and Faculties/Boards

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

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

Open Faculty/Board Meetings

If you wish you may attend a faculty or board meeting. You should seek advice at the office of the faculty whose meeting you wish to attend.

Award of the University Medal

The University may award a bronze medal to undergraduate students who have achieved highly distinguished merit throughout their degree course.

Identification of Subjects by Numbers

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

Textbook Lists

Textbook lists are issued early in the year and are available from School and Faculty offices for re-enrolling students and from the Unisearch House Enrolment Centre for first year students.

Textbook Costs and Course-Related Costs

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

Co-operative Bookshop

Membership is open to all students, on initial payment of a fee of $12, refundable after 2 years.

General Studies Program

Almost all undergraduates in faculties other than Arts and Law are required to complete a General Studies program. The Department of General Studies within the Board of Studies in General Education publishes its own Handbook which is available free of charge. All enquiries about General Studies should be made to the General Studies Office, Room G56, Morven Brown Building, phone 2436.

Student Services and Activities

Accommodation

Residential Colleges

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

The Kensington Colleges

The Kensington Colleges comprise Basser College, Goldstein College and Philip Baxter College. They house 450 men and women students, as well as tutorial and administrative staff members. Some aspects of traditional College life are maintained in an atmosphere which emphasises co-operation and mutual respect. Apply in writing to the Master, PO Box 24, Kensington, NSW 2033.

International House

International House accommodates 154 male and female students from Australia and up to thirty other countries. Preference is given to more senior undergraduates and graduate students. Eight tutors are available to help students. Apply in writing to the Warden, International House, PO Box 1, Kensington, NSW 2033.

New College

New College is an Anglican college and it provides accommodation (with all meals) for 220 graduates and undergraduates, without regard to race, religion, or sex. The College has its own resident tutors, and a Senior Resident Academic Fellow, who sponsors a wide range of activities and encourages inter-disciplinary discussion. Apply to the Master, New College, Anzac Parade, Kensington 2033 (telephone 662 6066).

Shalom College

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

Warrane College

Warrane College provides accommodation for 200 men and is open to students of all ages, backgrounds and beliefs. The College offers a comprehensive tutorial program along with a wide range of activities, professional orientation and opportunities to meet members of the University staff informally. Non-resident membership is available to male students who wish to participate in College activities and to make use of its facilities. The general spiritual care of the College has been entrusted to Opus Dei. Enquiries: The Master, Warrane College, PO Box 123, Kensington 2033. Telephone (02) 662 6199.

Creston Residence

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

Other Accommodation

Off-campus Accommodation

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

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

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

Associations, Clubs and Societies

The Sports Association

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

The Association office is situated on the 3rd floor, Squarehouse, E4, lower campus, and can be contacted on extension 4880. The control of the Association is vested in the General Committee which includes delegates from all the clubs.

Membership is compulsory for all registered students, and the annual fee is as set out later, in **Rules and Procedures, Enrolment Procedures and Fees Schedules**, section **15. Fees.** Membership is also open to all members of staff and graduates of the University on payment of a fee as prescribed in the By-laws of the Association. All members are invited to take part in any of the activities arranged by the Association, and to make use of the University's sporting and recreational facilities.

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

School and Faculty Associations

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

Australian Armed Services

The University maintains links with the Royal Australian Navy, the Australian Army Reserve and the Royal Australian Air Force, and opportunities exist for student participation in their activities.

Chaplaincy Centre

The University Chapel

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

Chaplaincy Service

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

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

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

Student Services

The Student Services staff, located on the first floor of the Chancellery, will help those students who have problems and need advice but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with those enquiries and with off-campus housing and student loan matters, the staff is especially concerned with the problems of physically handicapped and disabled students, overseas students, and aboriginal students.

All enquiries should be made either at Room 148E or by telephoning extension 3114 (general enquiries).

Sport and Recreation Section

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

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

It makes bookings for use of sporting facilities including tennis courts and playing fields. This section is located on the 3rd Floor, Squarehouse, E4, lower campus. The various services may be contacted by phone on the following extensions: Recreation Program 4884; Grounds Bookings 4878; Tennis Bookings 4877; Sports Association 4880.

Physical Education and Recreation Centre

The Sport and Recreation Section provides a recreational program for students and staff at the Physical Education and Recreation Centre. The Centre consists of eight squash courts, seven tennis courts, a main building, and a 50-metre indoor heated swimming pool. The main building has a large gymnasium and practice rooms for fencing, table tennis, judo, weight-lifting, karate and jazz ballet, also a physical fitness testing room. The recreational program includes intramurals, teaching/coaching, camping. The Centre is located on the lower campus adjacent to High Street. The Supervisor at PERC may be contacted on extension 4884.

Student Counselling and Research Unit

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

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

Appointments are offered throughout the academic year and during recesses between 8 am to 5 pm on week days (up to 7 pm on some evenings). A 'walk-in' service for short interviews is available between 9 am and 5 pm. Appointments may be made by phoning extension 5418 between 8.30 am and 5.30 pm.

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

Careers and Employment Section

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

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

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

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

For further information, telephone as follows: careers and employment assistance 3122 or 3123; long vacation industrial training 3124.

Student Health Unit

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

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

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

Appointments may be made by calling at the centre or by telephoning extension 5425, 5426 or 5427 during the above hours.

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

The Students' Union

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

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

Membership of the Students' Union is compulsory for all registered students of the University; the annual subscription for full-time and part-time students is set out later, in **Rules and Procedures, Enrolment and Procedures and Fees Schedules,** section **15. Fees.** All alumni of the University are eligible for Life Membership.

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

The Students' Union has three full-time officers who are elected each year by popular ballot. They are the President, who is mainly the political figure-head of the Union; the Secretary/Treasurer, who organizes the smooth operation of the SU offices, keeps the membership rolls up to date, and oversees the financial operations; and the Women's Officer who represents women on campus and formulates, maintains and co-ordinates the Students' Union policy on women's affairs.

Other officers are the Education Vice-President, who works towards the implementation of Students' Union education policy; the Education Officer concerned with helping students with problems relating to TEAS, Show-Cause and other matters relevant to their courses; the Vice-President who ensures the efficient running of CASOC: and the Director of Overseas Students who deals with specific problems these students may encounter while in Australia.

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

1. Publication of the Student Paper *Tharunka.*

2. Production of the student video program *Campuswide.*

3. A free legal service run by a qualified lawyer employed by the Students' Union Council.

4. The Secondhand Bookshop for cheap texts.

5. A child care centre, *House at Pooh Corner.*

6. CASOC (Clubs and Societies on Campus) which provides money from the SU for affiliated clubs and societies on campus.

7. A video service with access for students to equipment and advice.

8. A noticeboard for casual job vacancies.

9. Organization of orientation for new students.

The SU has two offices on campus. One is located at the back of the Library Lawn (between the Chancellery and the Morven Brown Building), where the S.U. President, Education Vice-President, Education Officer, Clubs and Societies Secretary and Postgraduate Officer are available to discuss student problems. The other is on the Second Floor of the Squarehouse (above the bar) at the bottom end of campus, where the Secretary/Treasurer, Women's Officer, Overseas Student Director, the full-time Solicitor, *Tharunka* and *Campuswide* provide information and student services.

The University Library

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

For details consult **Faculty Information** in the relevant Faculty Handbook.

There are also library services at other centres:

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

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

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

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

The University Union

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

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

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

The Union operates a licensed Bar and twelve Food Service points on the campus, providing services ranging from take-away snacks and cafeteria-type meals to an à la carte restaurant operation.

Shops run directly by the Union are the Logo Shop (University-crested gifts, mementos and clothing) and three news-agency outlets which also sell stationery, drawing materials and calculator supplies. Other Union facilities include banking, credit union, hairdressing and optical dispensing. There is also a beauty salon, a delicatessen, a clothing shop and pharmaceutical, dental, computing and travel services.

Shower, meeting, games, music practice, reading, craft and dark rooms are provided as well as a Student Resource Area where photocopying, screen printing, stencil cutting and typewriter services are available.

The Union's cultural activities program encompasses creative leisure classes, lunch hour concerts and films, market days and exhibitions.

Further information on Union programs, activities and services is provided in the Annual Union Handbook and in the Creative Leisure Classes and Activities brochures published each session.

Financial Assistance to Students

Tertiary Education Assistance Scheme

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

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

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

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

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

Other Financial Assistance

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

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

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

3. Early in 1973 the Commonwealth Government made funds available to the University to provide loans to students in financial difficulty. The loans are to provide for living allowances and other approved expenses associated with attendance at university. Students are required to enter into a formal agreement with the University to repay the loan. The University is unable to provide from the fund amounts large enough for all or even a major part of the living expenses of a student.

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

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

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

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

Financial Assistance to Aboriginal Students

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

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

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

Rules and Procedures

The University, in common with other large organizations, has established rules and procedures which are designed for the benefit of all members of the University. In some cases there are penalties (eg fines or exclusion from examinations) for non-compliance. Any student who, after carefully reading the rules set out in the following pages, requires further information on their application should seek further advice, in the first instance, at the Enquiry Counter in the North Wing of the Chancellery Building.

General Conduct

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

Appeals

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

Admission and Enrolment

The Student Enquiry Counter, located near the Cashier in the Chancellery on the upper campus, provides information for students on admission requirements, undergraduate and graduate courses and enrolment procedures. Faculty handbooks and the Calendar may be purchased from the Cashier. The Enquiry Counter is open from 9 am to 1 pm and 2 pm to 5 pm, Monday to Friday. During enrolment it is also open on some evenings.

Information may be obtained here about admission to first year undergraduate courses, special admission, admission with advanced standing and admission on overseas qualifications. Applications are also received from students who wish to transfer from one course to another, resume their studies after an absence of twelve months or more, or seek any concession in relation to a course in which they are enrolled.

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

It is essential that the closing dates for lodgement of applications are adhered to. For further details see the section on **Enrolment Procedures and Fees**.

Students wishing to enrol as higher degree candidates should first consult the Head of the School in which they wish to study. An application is then lodged on a standard form and the Postgraduate Section, after obtaining a recommendation from the Head of School, refers the application to the appropriate Faculty or Board of Studies Higher Degree Committee.

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

First Year Entry

Those seeking entry to first year courses in one or more of nineteen tertiary institutions in the State including all universities are required to lodge a single application form with the Universities and Colleges Admissions Centre (GPO Box 7049, Sydney 2001). On the application form provision is made for applicants to indicate preferences for courses available in any one of the six universities and the other tertiary institutions. Students are notified individually of the result of their applications and provided with information regarding the procedures to be followed in order to accept the offer of a place at this university. Enrolment is completed at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

Deferment of First Year Enrolment

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

Enrolment Procedures and Fees Schedules 1985

1. Introduction

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

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

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

If a student is unable to pay the fees the enrolment form must still be lodged with the Cashier and the student will be issued with a 'nil' receipt. The student is then indebted to the University and must pay the fees by the end of the second week of the session for which enrolment is being effected.

Penalties apply if fees are paid after the time allowed (see section **16.** below) unless the student has obtained an extension of time in which to pay fees from the Admissions Office, the Chancellery. Such an application must be made before the fee is due. Payment may be made through the mail, in which case it is important that the student registration number be given accurately. Cash should not be sent through the mail.

2. New Undergraduate Enrolments

Persons who are applying for entry in 1985 must lodge an application for selection with the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 2 October 1984.

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

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

Application forms and details of the application procedures may be obtained from the Student Enquiries Counter, Ground Floor, North Wing of the Chancellery Building.

3. Re-enrolment

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

Students who are continuing courses (or returning after approved leave of absence) should enrol through the appropriate school in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Student Enquiries Counter in the Chancellery and from School offices. Those who have completed part of a course and have been absent without leave need to apply for entry through the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 2 October 1984.

4. Restrictions Upon Re-enrolling

Students who in 1984 have infringed the rules governing re-enrolment should not attempt to re-enrol in 1985 but should follow the written instructions they will receive from the Registrar.

5. New Research Students

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

6. Re-enrolling Research Students

Students undertaking purely research degree programs (course codes 0-2999) will be re-enrolled automatically each year and sent an account for any fees due.

7. Submission of Project Report

Students registered for formal masters degree programs (course codes **8000-9999**) who at the commencement of Session 1 have completed all the work for a degree or diploma except for the submission of the relevant thesis or project report are required to re-enrol by the end of the second week of Session 1. Completion of enrolment after then will incur a penalty (see section **16.** below).

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

8. Enrolments by Miscellaneous Students

Enrolments by Miscellaneous students are governed by the following rules:

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

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

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

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

(5) There are quota restrictions on the number of students allowed to enrol as miscellaneous, irrespective of whether they have approval from the Head of School. Applicants with written Head of School approval may be permitted to enrol providing there are places available in the quotas.

9. Final Dates for Completion of Enrolment

No enrolments for courses extending over the whole year or for Session 1 only will be accepted from new students after the end of the second week of Session 1 (15 March 1985) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned; no later year enrolments for courses extending over the whole year or for Session 1 only will be accepted after the end of the fourth week of Session 1 (29 March 1985) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned. No enrolments for courses in Session 2 only will be accepted after the end of the second week of Session 2 (2 August 1985) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned.

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

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

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

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

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

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

New students are issued with cards on enrolment if eligible.

New graduate students should complete an application for a card when they enrol unless they already possess one from previous study at the University. The card can be collected from the second floor of the University Union Blockhouse approximately three weeks after enrolment. The fees receipt may be used as necessary until the card is available.

11. Payment of Fees

The fees and charges which are payable include those charges raised to finance the expenses incurred in operating activities such as the University Union, the Students' Union, the Sports Association, and the Physical Education and Recreation Centre. Penalty payments are also incurred if a student fails to complete procedures as required. Charges may also be payable, sometimes in the form of a deposit, for the hiring of kits of equipment in certain subjects. Accommodation charges, costs of subsistence on excursions, field work, etc, and for hospital residence (medical students) are payable in appropriate circumstances.

12. Assisted Students

Scholarship holders and sponsored students who have not received an enrolment voucher or appropriate letter of authority from their sponsor at the time when they are enrolling should complete their enrolment by paying their own fees.

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

Those unable to pay their own fees in these circumstances can apply for an extension of time in which to pay. Such an application must be made before the fees are due.

13. Extension of Time

Students who are unable to pay fees by the due date may apply for an extension of time, which may be granted in extenuating circumstances. Such applications must be made before the due date.

14. Failure to Pay Fees and Other Debts

Students who fail to pay prescribed fees or charges or are otherwise indebted to the University and who fail either to make a satisfactory settlement of indebtedness upon receipt of due notice or to receive a special exemption ceases to be entitled to the use of University facilities. Such students are not permitted to register for a further session, to attend classes or examinations, or to be granted any official credentials. In the case of students enrolled for Session 1 only or for both Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (26 April 1985). In the case of students enrolled for Session 2 only this disbarment applies if any portion of fees is outstanding after the end of the sixth week of Session 2 (30 August 1985).

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

15. Fees

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

University Union Entrance Fee

Payable on first enrolment $38

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

Student Activities Fees

All students (with the exceptions set out in section **17.** below) are required to pay the following fees if enrolling for a program involving two sessions. Those enrolling for only one session will pay the full University Union Entrance Fee, if applicable, and one-half of any other fees due.

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

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

Student Activities Fees are adjusted annually by a system of indexation and those set out below are current in 1984 and are therefore subject to an increase in 1985.

University Union annual subscription $108

Sports Association annual subscription $23

Students' Union Annual Subscription

Students enrolling in full-time courses $32

Students enrolling in part-time courses or as miscellaneous students $26

Miscellaneous Fund annual fee $38

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

Special Examination Fees

Examinations conducted in special circumstances for each subject $20

Review of examination results for each subject $20

Other Charges

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

16. Penalties

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

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

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

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

17. Exemptions — fees

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

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

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

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

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

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

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

Institutions approved are: Australian Film and Television School, New South Wales Institute of Technology, Sydney College of Advanced Education and Sydney College of Chiropractic.

(6) Undergraduate students of a recognized university outside Australia who attend the University of New South Wales with the permission of the dean of the appropriate faculty and of the head of the appropriate school or department to take part as miscellaneous students in an academic program relevant to their regular studies and approved by the authorities of their own institution are exempt from all Student Activities Fees and the University Union Entrance Fee.

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

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

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

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

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

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

18. Variations in Enrolment (including Withdrawal)

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

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

(3) Enrolment in additional subjects

Applications for enrolment in additional subjects must be submitted by:

29 March 1985 for Session 1 only and whole year subjects;
16 August 1985 for Session 2 only subjects.

(4) Withdrawal from subjects

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

(a) for one session subjects, the end of the seventh week of that session (19 April or 13 September)

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

(5) Withdrawal from Course – Refunds – Student Activities Fees

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

(a) If notice of withdrawal from a course is received by the Student Records and Scholarships Office before the first day of Session 1, a refund of all Student Activities Fees paid will be made.

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

(c) If the notice of withdrawal is given before the end of the fourth week of Session 1 (29 March 1985) a full refund of Student Activities Fees paid will be made; if notice is given before the end of the seventh week of Session 1 (19 April 1985) a refund of three-quarters of the Student Activities Fees paid will be made; if notice is given before the beginning of Session 2 (22 July 1985) a refund of one-half of the Student Activities Fees paid will be made; if notice is given before the end of the seventh week of Session 2 (13 September 1985) a refund of one-quarter of Student Activities Fees paid will be made; thereafter no refund will be made except that provided for in (d) below.

(d) If a student's enrolment in any year is for one session only and the student gives notice of withdrawal prior to the end of the fourth week of that session (29 March or 16 August 1985) a full refund of Student Activities Fees paid will be made; if notice is given before the end of the seventh week of that session (19 April or 13 September 1985) a refund of one-half of the Student Activities Fees paid will be made; thereafter no refund will be made.

(e) The refunds mentioned in (c) and (d) above may be granted by the Deputy Registrar (Student Services) to a student unable to notify the Student Records and Scholarships Office in writing by the times required provided evidence is supplied that the student has ceased attendance by those times.

(6) Acknowledgements

The Student Records and Scholarships Office will acknowledge each application for a variation in enrolment (including withdrawals from subjects) as follows:

(a) variations lodged before the Friday of the seventh week of each session (19 April or 13 September) will be incorporated in the *Confirmation of Enrolment Program* notice forwarded to students on 29 April or 23 September as appropriate

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

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

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

19. Exemption – Membership

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

Leave of Absence

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

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

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

Course Transfers

Students wishing to transfer from one course to another must complete and submit an application form, obtainable from the office of the Admissions Section, the Chancellery, by Friday 11 January 1985.

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

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

Students should also advise the enrolling officer in the school in which they were enrolled in 1984 of their intention to transfer.

Admission with Advanced Standing

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

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

2. where students transfer from another university such students shall not in general be granted standing in this University which is superior to what they have in the University from which they transfer;

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

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

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

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

Resumption of Courses

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

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

Examinations

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

Timetables

Provisional timetables indicating the dates and times of examinations are posted on the University noticeboards in May and October. Students must advise the Examinations Section (the Chancellery) of any clash in examinations.

Final timetables indicating the dates, times, locations, and authorized aids are available for students two weeks before the end of each session.

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

Assessment of Course Progress

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

Examination Results

Grading of Passes

Passes are graded as follows:

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

Pass Conceded

A pass conceded may be granted provided that the overall performance is considered to warrant such a concession. A pass conceded in a subject will allow progression to another subject for which the former subject is a prerequisite.

Pass Terminating

A pass terminating may be granted provided that the overall performance is considered to warrant such a concession. A pass terminating does not allow progression to another subject for which the former subject is a prerequisite.

Availability of Results

Final examination results will be posted to a student's term address, or vacation address if requested. Forms requesting that results be posted to a vacation address and change of address forms are obtainable at the Student Enquiry Counter, the Chancellery. Forms can be accepted up to Friday 28 June for Session 1 results and Friday 29 November for Session 2 and whole year results. Results are also posted on School noticeboards and in the University Library. Results on noticeboards are listed *by Student Registration Number.*

No examination results are given by telephone.

Review of Results

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

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

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

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

Special Consideration

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

Such requests should be made as soon as practicable after the occurrence and in any event no more than seven days after the final examination in a subject.

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

Physical Disabilities

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

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

Use of Electronic Calculators

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

Examinations Held Away from the Campus

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

Arrival at Examinations

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

Reading the Examination Paper

The examination paper will be available for reading ten minutes before the instruction is given to commence writing.

Use of Linguistic Dictionaries

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

Academic Misconduct

Students are reminded that the University regards academic misconduct as a very serious matter. Students found guilty of academic misconduct are usually excluded from the University for two years. Because of the circumstances in individual cases the period of exclusion can range from one session to permanent exclusion from the University.

The following are some of the actions which have resulted in students being found guilty of academic misconduct in recent years: use of unauthorized aids in an examination; submitting work for assessment knowing it to be the work of another person; improperly obtaining prior knowledge of an examination paper and using that knowledge in the examination; failing to acknowledge the source of material in an assignment.

Conduct of Examinations

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

1. Candidates are required to obey any instruction given by an examination supervisor for the proper conduct of the examination.

2. Candidates are required to be in their places in the examination room not less than fifteen minutes before the time for commencement.

3. No bag, writing paper, blotting paper, manuscript or book, other than a specified aid, is to be brought into the examination room.

4. Candidates shall not be admitted to an examination after thirty minutes from the time of commencement of the examination.

5. Candidates shall not be permitted to leave the examination room before the expiry of thirty minutes from the time the examination commences.

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

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

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

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

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

Writing in Examinations

Candidates are permitted to take pens, pencils and erasers into the examination room but are advised that all answers must be written in ink. Except where expressly required, pencils may be used only for drawing, sketching or graphical work.

Acknowledgement of Sources

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

Further Assessment

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

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

Restrictions upon Student Re-enrolling

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

First Year Rule

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

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

Repeated Failure Rule

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

General Rule

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

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

The Session-Unit System

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

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

Exemption from Rules by Faculties

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

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

Showing Cause

6. (1) Students wishing to show cause must apply for special permission to re-enrol. Application should be made on the form available from the Registrar and must be lodged with the Registrar by the dates published annually by the Registrar. A late application may be accepted at the discretion of the University.

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

Appeal

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

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

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

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

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

The decision of the Committee shall be final.

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

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

Exclusion

8. (1) Students who are required to show cause under the provisions of Rules **1.** or **3.** and either do not attempt to show cause or do not receive special permission to re-enrol from the Admissions and Re-enrolment Committee (or the Re-enrolment Committee on appeal) shall be excluded, for a period not in excess of two years, from re-enrolling in the subjects and courses on account of which they were required to show cause. Where the subjects failed are prescribed as part of any other course (or courses) they shall not be allowed to enrol in any such course.

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

Re-admission after Exclusion

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

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

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

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

(4) Students whose applications for re-admission to a course or subject are unsuccessful (see **9.** (2) (a), (b) respectively) will be invited to appeal to the Re-Enrolment Committee of the Professorial Board. The decision of the Re-Enrolment Committee will be final.

10. Students who fail a subject at the examinations in any year or session and re-enrol in the same course in the following year or session must include in their programs of studies for that year or session the subject which they failed. This requirement will not be applicable if the subject is not offered the following year or session, is not a compulsory component of a particular course, or if there is some other cause which is acceptable to the Professorial Board, for not immediately repeating the failed subject.

Restrictions and Definitions

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

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

Schedule A

(See First Year Rule **1.** above)

Where the minimum requirement is half the program, this is defined as half the sum of the unit values of all the subjects in a student's program.

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
Applied Science	Half the program	3000-3220 4190-4220	One-session subjects: UV 1 Two-session subjects: UV 2
Architecture	Half the program	3270, 3275, 3330	Elective subjects: UV 0
			All other subjects: appropriate UV corresponding to credit points*
		3320	All subjects: UV equal to the allocated hours*
		3360, 3380	Elective subjects: UV 0
			All other subjects: UV equal to the allocated hours*
Arts	18 Level I credit points	3400-3420	
Biological Sciences	4 units	3430	Science subjects: appropriate UV*
			Arts subjects: 6 credit points = UV 1 12 credit points = UV 2
Commerce	Three subjects	3490-3595 FT in both sessions	
	Two subjects	3490-3595 PT in either session	
Engineering	Half the program including Physics I or Mathematics I	3610, 3660, 3680, 3700	5.061: UV 0 One-session subjects: UV 1 Two-session subjects: UV 2
	Half the program including Mechanics of Solids or Mathematics I	3620, 3730	All subjects: UV equal to the allocated hours*
	Half the program including Physics I or Mathematics I	3640, 3720	One-session subjects: UV 1 Two-session subjects: UV 2
	Half the program	3740-3760	One-session subjects: UV 1 Two-session subjects: UV 2
Law	Half the program	4710-4790	One-session subjects: UV 1 90.741: UVO
			All other two-session subjects: UV 2
Medicine	Half the program	3800	80.010: UV 3 81.001: UV 3 81.002: UV 6 70.001: UV 4
			One General Studies elective: UV 1
Military Studies	Half the program	BA, BSc	All subjects: UV 1
		BE	All subjects: appropriate weighted mark*
Professional Studies	Half the program	4030, 4040	All subjects: UV 1
		4070-4080	All subjects: appropriate UV*
			One General Studies elective: UV1
Science	Half the program	3910, 3950	All subjects: appropriate UV*
			One General Studies elective: UV 1
Science and Mathematics	2 units	3970	All subjects: appropriate UV*
			One General Studies elective: UV 1

*For details see the appropriate Faculty Handbook.

Admission to Degree or Diploma

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

Students who have indicated on their enrolment form that they are potential graduands are forwarded an application form with their *Confirmation of Enrolment Program* notice in September (or, in the case of students who expect to satisfy requirements at the end of Session 1, with the form issued in April). Students who do not complete an application form will not graduate; students who do not return their application form by the due date will graduate at a later series of ceremonies.

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

*For details see the appropriate Faculty Handbook.

28 February for those completing requirements at the end of Session 2.

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

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

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

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

Attendance at Classes

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

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

Absence from Classes

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

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

Student Records

Confirmation of Enrolment Program notices are sent to all students on 29 April and 23 September. It is not necessary to return these forms unless any of the information recorded is incorrect. If amendments need to be made, students should contact the appropriate course office.

Release of Information to Third Parties

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

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

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

Change of Address

The Student Records and Scholarships Office of the Registrar's Division should be notified as soon as possible of any change of address. Failure to do this could lead to important correspondence (including results of assessment) going astray. The University cannot accept responsibility if official communications fail to reach students who have not given notice of their change of address. *Change of Address Advice* forms are available at Faculty and School offices and from the Student Enquiry Counter in the north wing of the Chancellery.

All communications from the University will be sent to the Session or Term address except when arrangements are made otherwise in the case of results of assessment (see **Examinations: Availability of Results,** earlier in this section). *Change of Address Advice* forms will be accepted up to Friday 29 November, except for final-year students wishing to change their *Application for Admission for Degree/Diploma* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

Ownership of Students' Work

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

Notices

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

Parking within the University Grounds

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

Academic Dress

Information about the University's academic dress requirements may be obtained from the Alumni and Ceremonials Section, Room 148E, the Chancellery (phone extension 3111).

Further Information

Lost Property

All enquiries concerning lost property should be made to the Superintendent (Patrol and Cleaning Services) on extension 3460 or to the Lost Property Office at the Union.

The Calendar

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

Foreword

The Faculty of Engineering Handbook

This handbook aims to provide information concerning the requirements for admission, enrolment and conditions for the award of degrees and diplomas in the Faculty together with descriptions of the subjects available. **It is important that each student in the Faculty becomes well acquainted with the information presented here.** In addition to this Handbook, pamphlets and brochures issued in conjunction with the enrolment period and Orientation Week are available. These should be consulted, together with the University Calendar, for further information on courses.

The Faculty of Engineering

The Faculty consists of five Schools: Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying and the Centre for Biomedical Engineering. In addition, the Faculty of Engineering has joined with the Faculty of Applied Science in establishing the Centre for Remote Sensing.

School of Civil Engineering

The School of Civil Engineering consists of five departments: Civil Engineering Materials, Engineering Construction and Management, Structural Engineering, Transport Engineering and Water Engineering. The School conducts both part-time and full-time undergraduate courses in Civil Engineering. In addition, the School conducts graduate courses and carries out graduate research programs in many fields.

The Department of Civil Engineering Materials includes the fields of Soil Mechanics, Rock Mechanics, Concrete Technology, Plastics and Timber, Metals and Welding Technology, Pavement Engineering, and Continuum and Statistical Mechanics. The Materials Laboratories are located at Kensington.

The Department of Engineering Construction and Management is responsible for the fields of Civil Engineering Systems, Engineering Economy, Project Planning and Management and Civil Engineering Construction.

The Department of Structural Engineering covers the fields of Structural Analysis, Structural Design, Stress Analysis and Solid Mechanics. The Model Structures, Experimental Stress Analysis and Structural Dynamics Laboratories are at Kensington. The Structural Testing Laboratory is at King Street, Randwick.

The Department of Transport Engineering is concerned with the planning, design, construction and operation of transport systems by the application of engineering techniques, statistical analysis, land use and transport modelling, economic evaluations and environmental impact studies.

The Department of Water Engineering encompasses the fields of Hydraulics, Hydrology, Water Resources and Public Health Engineering. The Public Health Engineering Laboratory is located

at Kensington and there is a pilot scale laboratory at Randwick for research and teaching. The Hydrology research centre is also at Kensington, but a substantial amount of investigation is carried out in the field. The Water Research Laboratory is located at Manly Vale as is the centre for research and graduate instruction in hydraulics.

School of Electrical Engineering and Computer Science

The School of Electrical Engineering and Computer Science comprises five departments — Communications, Computer Science, Electric Power Engineering, Electronics, and Systems and Control. The School also houses the Joint Microelectronics Research Centre.

Special laboratories are equipped for work in the areas of Microelectronics, Microwaves, Digital Systems, Power Systems, Computer Control, Machines and Acoustics. A Measurements Laboratory provides a calibrating service under certificate from the National Association of Testing Authorities.

The School offers undergraduate courses leading to the award of the degree of Bachelor of Engineering which may be taken on either a full-time basis, normally over four years, or on a part-time basis, normally over six years, or a combination of these. The School continues to offer the later stages of the six year part-time courses leading to the award of the degree of Bachelor of Science (Engineering) although no new enrolments are being accepted. Students have considerable choice of subjects in the latter half of the courses so they may concentrate, if desired, on one of the main streams of modern electrical engineering, namely electronics (including microelectronics and communications), electric energy, or computers and systems.

A major in Computer Science is available in the three year BSc program in the Faculty of Science. There are also combined courses (normally five years full-time) which lead to the award of two degrees (BE and BSc, or BE and BA).

In addition to the supervision of programs of advanced study and research for candidates undertaking a research degree leading to the award of the degree of Master of Engineering, Master of Science or Doctor of Philosophy, the School offers formal graduate courses leading to the award of the degree of Master of Engineering Science or a Graduate Diploma in Engineering.

School of Mechanical and Industrial Engineering

Undergraduate courses leading to the award of the degree of Bachelor of Engineering are offered in Mechanical, Industrial, and Aeronautical Engineering, and in Naval Architecture. These courses may be taken either on a full-time basis, normally over four years or on a combined full-time/part-time basis.

The first two years of the degree, taken full-time, or the first three years, taken part-time, are common to all four courses within the School. Thus, a final decision on the discipline to be followed need not be made until the end of Year 2 for full-time and the end of Year 3 for part-time students.

The School offers combined courses (normally five years full-time) which lead to the award of two degrees (BE BSc or BE BA). These courses enable students to major in Computer Science, Materials Science, Mathematics, Physics, Statistics or another relevant field of study while pursuing their chosen engineering speciality.

Formal graduate courses of study, leading to the award of the degree of Master of Engineering Science or to the award of a Graduate Diploma in Engineering, are available. The areas of specialization cover the major fields of Mechanical and Industrial Engineering.

Graduates with a good first degree may register for the higher degrees of Master of Engineering and Doctor of Philosophy. Current research fields include Aerodynamics, Agricultural Engineering, Applied Plasticity, Automatic Control, Bio-mechanics, Linkage Kinematics, Dynamics, Gas Dynamics, Heat Transfer, Fluid Mechanics, Metal Cutting, Ship Structures, Operations Research, Refrigeration and Air Conditioning, Two-phase Flow and Industrial Automation.

Undergraduates who are interested in working for a research degree should consult the Head of School towards the end of their final year. Advice will be given to all students during their third year so that each can select the best possible combination of final year elective subjects.

School of Nuclear Engineering

The School of Nuclear Engineering operates at the graduate level in the Faculty of Engineering. A fourth year undergraduate subject in Nuclear Power Technology is provided as an elective for other Schools (23.051 Nuclear Power Technology).

In addition to the supervision of programs of advanced study and research for candidates undertaking a research degree leading to the award of Master of Engineering, Master of Science or Doctor of Philosophy, the School offers a formal graduate course leading to the

award of the degree of Master of Engineering Science. This formal course aims specifically at the education of engineers for the detailed understanding, analysis and assessment of nuclear reactors and nuclear power systems. Particular attention is given to the mathematical, numerical and computational techniques which are relevant to nuclear engineering.

Special research interests in the School include the general field of fluctuation phenomena and noise in nuclear reactors, the coupled thermomechanical, fluid dynamics and nuclear aspects of reactor fuel elements and coolant channels, and the subject of reactor utilization and reactor strategy.

Special digital and analogue equipment for the analysis and recording of random signals has been acquired for experimental noise research. Through the Australian Institute of Nuclear Science and Engineering, the special facilities of the Australian Atomic Energy Commission at the Lucas Heights Research Laboratories can be made available for research purposes. Close personal contact is maintained between members of the School and the Nuclear Technology Division at Lucas Heights.

School of Surveying

The School of Surveying offers a full-time course of four years' duration leading to the degree of Bachelor of Surveying. Alternatively, the course may be taken in a sandwich form in which a student may, after completing the first year of the course on a full-time basis, alternate his or her studies with periods of employment by taking leaves of absence of up to two consecutive sessions at a time thereafter. The course taken in this form requires a maximum period of seven years. In addition to surveying, the course also includes studies in geodesy, photogrammetry and cartography, astronomy, computations and land studies.

The School also offers a full-time course of four years' duration leading to the degree of Bachelor of Surveying Science. It is designed to give an interested student the opportunity to obtain greater depth as an undergraduate in one or more of the disciplines associated with surveying: land development, cartographic science, geodesy and geophysics, environmental studies, remote sensing and photogrammetry.

The graduate courses offered are Master of Surveying Science and the Graduate Diploma in Surveying. The research degrees available are the Master of Surveying and Doctor of Philosophy.

The School is located in the Geography and Surveying Building. Facilities include four photogrammetry laboratories with several equipment types, an observatory platform for positional astronomy and a comprehensive range of field equipment for surveying and geodesy. Computing facilities include a number of terminals to the University's time-shared central computer system, a control minicomputer within the School's Image Data Analysis Centre, and an array of personal computers. A library of programs is maintained for use with the different computers.

Current research is in the fields of satellite geodesy and geodynamics, atmospheric refraction, photogrammetry, remote sensing, positional astronomy, advanced surveying, cadastral systems and land management.

Centre for Biomedical Engineering

The Centre was established in 1976 as an interdisciplinary unit to promote and co-ordinate biomedical engineering studies and research being conducted by a number of schools within the University and teaching hospitals. Biomedical engineering involves the application of engineering techniques to biomedical problems with particular emphasis on clinical medicine.

The Centre offers graduate programs leading to the award of the degree of Master of Biomedical Engineering and the degree of Doctor of Philosophy. The Master's degree is obtained primarily through course work but includes a research project which is supervized in one of the Centre's associated laboratories, either on campus or in affiliated teaching hospitals. The doctorate is primarily a research degree which normally involves some formal course work.

The MBiomedE degree course is designed to cater for students with either a medical or engineering/science background and involves eighteen months of full-time study. Part-time students are also catered for. Initially, students with a medical background study basic engineering subjects such as mathematics, mechanics, electronics and computing, whilst students with a non-medical background take courses in biology, physiology, anatomy, pathology and biochemistry. At a later stage, students from both backgrounds choose electives from biomechanics, biophysics, biomaterials, medical instrumentation and mass transfer in medicine, as well as undertaking a research project.

Centre for Remote Sensing

The Centre was established in 1981 as a joint enterprise of the Faculties of Engineering and Applied Science to promote and co-ordinate remote sensing studies and research being conducted by various schools within the University. Remote sensing is the science of obtaining information about the earth's surface (in particular) using electromagnetic imaging systems mounted on aircraft and space platforms.

The Centre offers graduate programs leading to the award of the degree of Master of Engineering Science or Master of Applied Science and supervision for the degree of Doctor of Philosophy. A Graduate Diploma in Remote Sensing is also available. The Masters' programs encompass the fundamentals of remote sensing and remote sensing systems, ground investigations, concepts of data processing and pattern recognition, numerical analysis of data and information extraction leading to specific application studies. They are organized around a group of compulsory subjects, elective subjects and a project or research project which is supervised in one of the schools associated with the Centre.

Students from a wide variety of backgrounds can undertake the programs on a one year full-time or two year part-time basis and these may include engineering, geography, geology, surveying, planning, biology and agricultural or environmental sciences.

Safety Science

The Faculty offers a graduate program leading to the award of the degree of Master of Safety Science. A Graduate Diploma program in Safety Science is also available. These courses are provided in conjunction with the Faculties of Medicine, Commerce, Law and Applied Science. They are organized around a group of introductory subjects, core subjects and Safety Engineering elective subjects. Students from a wide variety of backgrounds may undertake the programs on a full-time or part-time basis.

Faculty of Applied Science

Courses in Chemical Engineering, Ceramic Engineering, Metallurgy, Metallurgical Process Engineering, Mining Engineering and Textile Engineering are offered by the Faculty of Applied Science. For further information on these courses students should consult the Calendar and Faculty of Applied Science Handbook.

Message from the Dean and the Chairman

A great deal of discussion has taken place within the Faculty in recent years concerning the type of education appropriate for an engineer and surveyor. Central to this discussion are the basic objectives which are implicit in the various engineering and surveying courses. These are to impart to and foster within its students the following:

Skills

- Technical and scientific and creative skills required to solve all aspects of engineering problems.

- An understanding of human interaction with the environment, so that the impact of engineering activity can be assessed.

Communication

- The ability to direct and manage engineering activities.

- The ability to communicate, with other members of the profession, with industrial personnel, administrators, and with members of the public.

Creativity

- The desire and ability for continuing self-education and reappraisal of current practice, including the ability to innovate new ideas and practices.

- The ability to evaluate independently and to criticise constructively their own work and the work of other engineers.

We hope to do much more than merely impart a body of knowledge to our graduates. Appropriate attitudes and skills for professional engineers operating into the twenty-first century must also be developed. Technology has come under increasing criticism from other sectors of society. It is no longer accepted that advances in technology are necessarily synonymous with the betterment of society, and future engineers must be prepared not only to take account of the ramifications of their work, but also to vindicate them to an increasingly doubtful public.

It is also important for you, as a student, to join in the development of yourself as a professional engineer. Engineering is a co-operative profession where teamwork is very important. Whilst at university you should take as many opportunities as you can to join in the activities which help to develop the whole person. Student clubs and professional institutions provide many opportunities for gaining knowledge and experience which will be valuable in your work as an engineer.

The staff and students collectively create an atmosphere of scholarship and learning. Staff are involved in research as well as in teaching. This research is vital if the quality of teaching is to be kept at a high intellectual standard. In addition the interested student will find a very wide

range of research activities. The common thread, however, will be the engineering method which is applied.

Students should take steps to ensure that the staff are fully aware of their problems and attitudes. There are committees in the schools which are concerned with student matters. The Faculty has student representation on its Education Committee, the Faculty and Faculty Executive Committees. We seek for membership of these committees articulate students who are able to assist in the development of a true university spirit of learning and enquiry.

N. L. Svensson
Dean
Faculty of Engineering

D. T. Howell
Chairman
Faculty of Engineering

Faculty Information

Who to Contact

If you require advice about enrolment, degree requirements, progression within courses, subject content and requirements, contact the appropriate school representative listed below:

School of Civil Engineering: Mr R. W. Prior, Room 406, School of Civil Engineering.

School of Electrical Engineering and Computer Science: Dr H. S. Blanks, Room G6, *or* Ms R. C. Horwood, School Office, School of Electrical Engineering and Computer Science.

School of Mechanical & Industrial Engineering: Dr J. E. Baker, Room 105, *or* Mr G. Dusan, Room 107, School of Mechanical & Industrial Engineering.

School of Nuclear Engineering: Professor J. J. Thompson, Room 205, Mechanical Engineering Building.

School of Surveying: Administrative Assistant, School Office, Room 529, Geography & Surveying Building.

Centre for Biomedical Engineering: Associate Professor P. C. Farrell, 34-36 Botany Street, Randwick, NSW 2031.

Centre for Remote Sensing: Dr J. A. Richards, Room 613, Geography and Surveying Building.

Important: As changes may be made to information provided in this handbook, students should frequently consult the noticeboards of the schools and the official noticeboards of the University.

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1985 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1985* 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.

Faculty of Engineering Library Facilities

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

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate students and senior undergraduate students in the pure and applied sciences, engineering and architecture. Details of the books, serials and microforms 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 for loan, but self-service photocopying facilities are available 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 always available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian Marian Bate

The Undergraduate Library

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

The Undergraduate Library provides a reader education program and reader assistance service aimed at teaching students the basic principles of finding information. Services of particular interest to undergraduates and academic staff are:

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

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

Undergraduate Librarian Pat Howard

Student Clubs and Societies

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

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

The following societies serve the interests of students in the various courses in the Faculty of Engineering: Biomedical Engineering Society (BioEngSoc); Civil Engineering Society (CIVSOC); Computing Science Association (CSA); Electrical Engineering Society (ELSOC); Mechanical Engineering Society (MECHSOC); Naval Architecture Students' Association (NASA); Surveying Society (SURVSOC).

Students are encouraged to participate in the activities of their societies. Enquiries should be directed initially to the general offices of the respective Schools.

Location of Laboratories outside Kensington Campus

Randwick

The Transport Engineering Laboratory, the Water and Pollution Control Laboratory and the Structures Laboratory of the School of Civil Engineering occupy buildings on the site of the old Tramway Depot at King Street, Randwick.

Manly Vale

The Water Research Laboratory of the School of Civil Engineering is located at King Street, Manly Vale.

International Association for the Exchange of Students for Technical Experience — IAESTE

IAESTE is an organization to facilitate overseas work in technical areas in 53 different countries throughout the world for students or recent graduates. It organizes visas, work periods for as little as 6 weeks or up to 12 months, lodging and an initial welcome.

In Australia IAESTE has a National Committee in Melbourne and local committees in the capital cities including Sydney. The UNSW local committee is made up of interested students and is run in association with the Careers and Appointments Service at Sydney University.

For more information write to the local committee President, IAESTE (UNSW), Union Box 43, UNSW, PO Box 1, Kensington 2033, or contact the local committee through the Students' Union.

The Institution of Engineers, Australia

The professional body for engineering in Australia is the Institution of Engineers, Australia, which has as its first objective 'to promote the science and practice of engineering in all its branches'.

The Institution functions through a series of divisions, the local one being the Sydney Division. Within each division are branches representing the main interests within the profession, eg civil, mechanical, electrical, chemical and transportation.

Students of an approved school of engineering may join the Institution as a student member (StudIEAust).

Student members receive the fortnightly publication *Engineers, Australia* advising of site tours, conferences, technical meetings of all branches, harbour cruises, film nights, etc. They also receive *The Transactions* which contains articles on a particular branch of engineering for a small fee.

Student members are also free to use the comprehensive library and reference facilities maintained by the Institution. The library is a handy place to obtain a rare book or periodical.

For more information and membership application forms, write to The Secretary, The Institution of Engineers, Australia, Sydney Division, PO Box 138, Milsons Point NSW 2061.

The Institution of Surveyors, Australia

During their years as undergraduates, students in the surveying course are encouraged to take the first steps in joining in the activities of the professional body which represents surveyors, The Institution of Surveyors. The aims of the Institution are to promote scientific, technical and educational aspects of surveying and to maintain high professional standards of practice and conduct. Student members receive the quarterly journal of the Institution of Surveyors, *The Australian Surveyor* and *Azimuth* which is published by the New South Wales Division of the Institution. Membership also entitles the student to attend all meetings of the Institution and to attend the annual Congress at a special concessional rate. Membership application forms are available at the office of the School of Surveying and from the Institution office, Third Floor, Guild House, 363 Pitt Street, Sydney.

The Rupert H. Myers Award in Materials Engineering

The University, in conjunction with the Department of Civil Engineering Materials in the School of Civil Engineering, makes an award, known as the Rupert H. Myers Award in Materials Engineering, which recognizes contributions made by individual engineers and scientists of international repute to the science of materials engineering. The selected candidate receives a silver medal and delivers the Rupert H. Myers Lecture as a key feature of a symposium concerned with the most recent developments in this field.

Undergraduate Study

The Faculty of Engineering consists of five Schools — Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying, the Centre for Biomedical Engineering and the Centre for Remote Sensing. The Schools of Civil Engineering, Electrical Engineering and Computer Science, and Mechanical and Industrial Engineering offer full-time courses leading to the award of the degree of Bachelor of Engineering, and part-time courses leading to the award of the degree of Bachelor of Engineering. Courses are also offered for the award of the combined degrees of Bachelor of Engineering, Bachelor of Science and Bachelor of Engineering, Bachelor of Arts. The School of Surveying offers full-time courses, which may also be taken in a sandwich form, leading to the award of the degrees of Bachelor of Surveying and Bachelor of Surveying Science. The School of Nuclear Engineering, the Centre for Biomedical Engineering and the Centre for Remote Sensing offer graduate courses only.

All the graduate activities of the Faculty are co-ordinated under the Graduate School of Engineering. For details of the graduate activities of the Faculty please see **Graduate Study** section later in this book.

First Year Programs

A student who has completed the first year of an undergraduate course in one school may apply for a transfer to a course in another school of the Faculty with credit for relevant subjects completed. However, as there are considerable differences in the various Year 1 programs, students are not granted complete exemption from Year 1 of the course to which the transfer is made.

General Rules for Progression

Progression in all undergraduate courses in the Faculty of Engineering is now permitted by subject. However:

1. Course programs will continue to be stated and timetabled by year or stage and it cannot be guaranteed that non-standard programs can be completed in the minimum number of years.

2. Students must satisfy the rules governing re-enrolment: in particular, these require students enrolled in the first year of a degree program to pass in at least half that program. Students are also required to show cause why they should be allowed to repeat a subject which has been failed more than once.

3. A student must satisfy the relevant prerequisite and co-requisite requirements. This will usually necessitate a student completing or attempting all subjects of a particular year or stage before proceeding to a subject in the next part of a course. Further details are available from the appropriate school.

4. Only in exceptional circumstances will a student be permitted to enrol in subjects extending over more than two years of the course or for more than twenty-eight hours of course work per week if a full-time student or fourteen hours per week if a part-time student. Students repeating subjects are required to choose a program which limits their hours of course work to twenty-two per week if a full-time student, and to eleven per week if a part-time student, unless they have the express permission of the Head of School to exceed these hours.

5. Notwithstanding the above, before a student can enrol in any non-standard program such program must meet with the approval of the Head of School. A non-standard program is one which involves enrolment in subjects from more than one year or stage, or comprises subjects which do not normally constitute a particular year's course work.

Prerequisites and Co-requisites

- A prerequisite unit is one which must be completed prior to enrolment in the unit for which it is prescribed.
- A co-requisite unit is one which must either be completed successfully before or be studied concurrently with the unit for which it is prescribed.

Full-time Study

Courses leading to the award of the degrees of Bachelor of Engineering in Civil, Electrical, Mechanical, Industrial and Aeronautical Engineering, and Naval Architecture may be taken by full-time study over a period of four years. Courses are also offered for the award of the combined degrees of Bachelor of Engineering, Bachelor of Science and Bachelor of Engineering, Bachelor of Arts. Four-year full-time courses in Surveying and Surveying Science are offered by the School of Surveying leading to the award of the degrees of Bachelor of Surveying and Bachelor of Surveying Science.

The award of the degree of Bachelor of Engineering is recognized by the Institution of Engineers, Australia, as meeting the examination requirements for admission to graduate and corporate membership. Substantial or complete recognition is accorded to these courses by overseas engineering institutions.

The award of the degree of Bachelor of Surveying is recognized by the Surveyors' Board of New South Wales as giving complete exemption from written examinations of the Board.

In the case of Bachelor of Surveying Science degree the New South Wales Surveyors' Board may require additional subjects for registration.

Industrial Training Requirements

All full-time engineering courses incorporate industrial training and reference should be made to the entries under each School heading for details of the arrangements applicable. All students are strongly recommended to gain further industrial experience in those long vacations where such training is not already prescribed.

The staff of the University will, where possible, assist students to obtain this employment, but it is emphasized that the primary responsibility for obtaining suitable industrial experience rests with each student. Progression to succeeding years of the course and the award of the degree are dependent on the completion of the requisite periods of industrial employment at a standard approved by the University.

Part-time Study

Courses leading to the award of the degrees of Bachelor of Engineering in Civil, Electrical, Mechanical, Industrial and Aeronautical Engineering and Naval Architecture may be taken by part-time study over a period of six or seven years, depending upon the course, or by an approved combination of part-time and full-time study.

Part-time study usually involves a combination of day-time and evening attendance. However it may not be possible to offer evening classes in later year subjects.

Part-time courses leading to the award of the degree of Bachelor of Science (Engineering) in these six fields may be taken over a period of six years, but these courses are being phased out and new enrolments are no longer accepted.

The award of the degree of BSc(Eng) is recognized at present by the Institution of Engineers, Australia, as meeting the examination requirements for admission to graduate and corporate membership.

Recognition by overseas engineering institutions varies in the different branches of engineering, and enquiries on this matter should be addressed to the Head of the appropriate School.

Students completing the BSc(Eng) degree course and wishing to qualify for the corresponding BE degree may, on the recommendation of the Head of the School, transfer to the corresponding full-time BE course provided they do not take out the BSc(Eng) degree. Further, provided they continue as registered students on transfer from one course to the other, they may retain any concession granted in the BSc(Eng) degree course.

Holders of the BSc(Eng) degree are eligible to proceed to the degree of Master of Engineering, Master of Engineering Science or Master of Surveying Science subject to the conditions for the award of these degrees set out in the Calendar.

Courses leading to the award of the BSc(Eng) degree are basically part-time and the prescribed industrial experience should be gained concurrently with the course of study (a minimum of three years of suitable engineering experience is required). Students transferring from full-time courses must, therefore, also satisfy these industrial experience requirements before being admitted to the degree of BSc(Eng).

The BSc(Eng) degree program may in some cases be accelerated by a student attending for one or more years full-time. For example, in all courses of the Faculty it is possible to take the equivalent of the first two part-time years in the full-time first year.

Combined Courses

Full-time courses of five years' duration are available for the award of two degrees, ie Bachelor of Engineering/Bachelor of Science (BE BSc); Bachelor of Engineering/Bachelor of Arts (BE BA). Courses for the award of the degree of BE BSc are available in Aeronautical, Civil, Electrical, Mechanical and Industrial Engineering and Naval Architecture. Courses are also available for the award of the degree of BE BA in Aeronautical, Electrical, Mechanical and Industrial Engineering and Naval Architecture.

Faculty of Engineering Prerequisite Requirements

Before students can enrol in a number of first year subjects they are required to be placed within a percentile range in specific Higher School Certificate subjects. The following table lists the Higher School Certificate examination prerequisites for first year subjects in the courses offered by the Faculty of Engineering.

Course	HSC Prerequisites for First Year Subjects	Percentile Range Required
Engineering — Aeronautical Engineering — Civil Engineering — Electrical Engineering — Industrial Engineering — Mechanical	2 u Mathematics* *or* 3 u Mathematics *or* 4 u Mathematics *and* 2 u Science (Physics) *or* 4 u Science (multistrand)	71-100 21-100 1-100 31-100 31-100
Naval Architecture	2 u Mathematics* *or* 3 u Mathematics *or* 4 u Mathematics *and* 2 u Science (Physics) *or* 4 u Science (multistrand)	71-100 21-100 1-100 31-100 31-100
Surveying Surveying Science	2 u Mathematics* *or* 3 u Mathematics *or* 4 u Mathematics *and* 2 u Science (Physics) *or* 4 u Science (multistrand)	71-100 21-100 1-100 31-100 31-100

*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).

Students are advised that lack of the specified subject prerequisite/s do not preclude selection to any course, but the required standard must be achieved before enrolment in the University subject is permitted.

The University conducts Bridging Courses to assist in remedying deficiences in subject levels. Further details are available from the **Students' Information Guide** published annually by the Universities and Colleges Admissions Centre (UCAC).

Introductory subjects are also available to students who do not have the Higher School Certificate prerequisite/s in Mathematics or Physics.

It should be noted that inclusion of these subjects in first year programs could prevent completion of a course in minimum time.

Effective communication is an essential requirement for the Professional Engineer. As part of their training for the profession, students are required to write reports and make verbal presentations during the undergraduate course. Therefore, a high level of competence in written and spoken English expression is expected.

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

The course leading to the award of the degree of Bachelor of Science (Engineering) is normally programmed over six years of part-time study in the University whilst the student is employed in industry. The regulations governing the award of this degree are as follows:

1. A candidate for the award of the degree of 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 training over such period as is prescribed concurrently with attendance in the course. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations and excursions to such an extent and in such a manner as is prescribed from time to time by the Professorial Board on the recommendation of the Faculty, and, in addition, undertake industrial training as approved by the Head of the School.

3. A student may be granted advanced standing by the Professorial Board on the recommendation of the appropriate Faculty but in each case a student must follow an approved course for at least three years with such period of approved industrial training as is prescribed before being eligible for admission to the degree.

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

5. Students shall be required to conform with the general rules relating to progression in University courses.

6. In special cases the Faculty may approve the variation of any of the preceding conditions.

Note: No new enrolments are being accepted into this course.

Conditions for the Award of the Degree of Bachelor of Engineering

1. A candidate for the award of the degree of 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 training for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations and excursions to such an extent and in such a manner as is prescribed from time to time by the Professorial Board on the recommendation of the Faculty.

3. A student may be granted advanced standing by the Professorial Board on the recommendation of the appropriate Faculty, but in each case must complete an adequate period of approved industrial training before being eligible for the degree. In addition to the above requirements a student coming from another institution must comply with the conditions laid down by the Professorial Board for admission with advanced standing.

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

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

5. In special cases the Faculty may approve the variation of any of the preceding conditions.

Conditions for the Award of the Degrees of Bachelor of Surveying and Bachelor of Surveying Science

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

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the School of Surveying and satisfy the examiners in the necessary subjects;

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations, excursions and field camps to such an extent and in such a manner as is prescribed from time to time by the Professorial Board on the recommendation of the Faculty.

3. A student may be granted advanced standing by the Professorial Board on the recommendation of the Faculty of Engineering. In addition to the above requirements a student coming from another institution must comply with the conditions laid down by the Professorial Board for admission with advanced standing.

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

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

5. In special cases the Faculty may approve the variation of any of the preceding conditions.

Undergraduate Study:

Course Outlines

School of Civil Engineering

Head of School
Professor T. G. Chapman

Executive Assistant to Head of School
Vacant

Senior Administrative Officer
Mr R. W. Prior

The School of Civil Engineering offers a course (3620) leading to the degree of Bachelor of Engineering (BE), at pass or honours level, which can be taken on a four-year full-time basis, on a part-time basis or on a combined full-time/part-time basis subject to the approval of the Head of School. Students intending to enter part-time study are advised that when the revised curriculum is introduced many subjects will be offered only in the daytime. Part-time students will normally take two years for each equivalent full-time year.

A five year full-time course (3730) leading to the award of the degrees of Bachelor of Engineering and Bachelor of Science (BE BSc) is offered. Students enrol initially in Course 3620 and apply for transfer to Course 3730 on completion of Year 1.

The requirements for the award of the BE degree include a period of at least sixty working days of approved industrial training prior to enrolment in the final year.

The degree of Bachelor of Engineering may be conferred as a Pass degree or as an Honours degree. There are two classes of Honours, Class I, and Class II in two divisions, and the award and grade of Honours are made in recognition of superior performance throughout the course.

3620
Civil Engineering — Full-time Course

Bachelor of Engineering
BE

A revised curriculum for Year 1 is being introduced in 1985. The corresponding curriculum for Years 2, 3 and 4 will be introduced in 1986.

Year 1 (Revised Course)

		Hours per week S1	S2
1.981	Physics*	4	3
2.991	Chemistry 1CE†		6
8.1110	Civil Engineering Practice		3
8.1120	Computing	3	
8.1130	Engineering Drawing	3	
8.1140	Statics	3	
8.1210	Engineering Construction 1	2	
8.1410	Dynamics and Vibration		3
8.1610	Fluid Mechanics		2
10.001	Mathematics‡	6	6
25.5112	Geology for Civil Engineers	3	
		24	23

*Students are advised to attempt 1.981 Physics 1CE but if timetabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt 1.001 Physics 1. On successful completion of this subject students will be exempted from one Technical Elective. Students who intend to apply for transfer to the Combined BE BSc degree program involving Level II/III Physics subjects must enrol in 1.001.

†Students who have not satisfied the Chemistry prerequisite for 2.991 Chemistry 1CE are required to take 2.111 Introductory Chemistry in Session 1 and 2.991 in Session 2. Students who intend to apply for transfer to the combined BE BSc programs involving Level II/III Chemistry subjects must enrol in 2.121 in Year 1 and 2.131 in Year 2 instead of 2.991.

‡Students who have achieved a certain standard may attempt 10.011 Higher Mathematics 1.

		Hpw S1	S2
Year 2			
8.172	Mechanics of Solids 2	4	0
8.1811	Structural Design 1A	3	0
8.1812	Structural Design 1B	0	3
8.2721	Civil Engineering Materials 1	4	0
8.2722	Civil Engineering Materials 2	0	4
8.311	Systems Engineering 1	2	0
8.312	Systems Engineering 2	0	2
8.571	Hydraulics 1	0	3
8.671	Engineering Construction	3	0
10.022	Engineering Mathematics 2	4	4
10.381	Statistics SC	2	0
29.441	Surveying for Engineers	0	6
29.491	Survey Camp†	0	3
	One General Studies elective**	4	0
		26	25

**See Electives on following page.

†Students are required to attend a one-week Survey Camp, which is equivalent to 3 class contact hours per week in a session.

Year 3			
8.173	Structural Analysis 1	3	0
8.174	Structural Analysis 2	0	3
8.1821	Structural Design 2A	3	0
8.1822	Structural Design 2B	0	3
8.2731	Geotechnical Engineering 1	2	0
8.2732	Geotechnical Engineering 2	0	2
8.2733	Rock Engineering	0	2
8.362	Engineering Computations	3	0
8.400	Transport Engineering 1	0	3
8.572	Hydraulics 2	3	0
8.573	Hydraulics 3	0	3
8.581	Water Resources 1‡	3	0
8.582	Water Resources 2	0	3
8.672	Planning and Management 1	0	4
	One General Studies elective**	4	0
		21	23

**See Electives on following page.

‡Includes 8 hours of Saturday fieldwork.

Year 4			
8.001	Industrial Training	0	0
8.191	Structural Engineering	3	0
8.2741	Concrete Technology	0	4
8.2742	Metals Engineering	2	0
8.401	Transport Engineering 2	0	3
8.583	Water Resources 3	3	0
8.673	Planning and Management 2	3	0
8.674	Planning and Management 3	0	3
8.051	Design Project—Materials	0	1¼
8.052	Design Project—Structures	0	1¼
8.053	Design Project—Water	0	1¼
8.054	Design Project—Construction	0	1¼
	One General Studies elective**	4	0
	Five Technical Electives**	6	9
		21	24

**See Electives on following page.

3620
Civil Engineering — Part-time Course

Bachelor of Engineering
BE

Stage 1 and **Stage 2**

New students select a suitable program from the Year 1 subjects.
Re-enrolling students are given appropriate status in the revised Year 1 program.

		Hours per week S1	S2
Stage 3			
8.172	Mechanics of Solids 2	0	4
8.2721	Civil Engineering Materials 1	0	4
8.2722	Civil Engineering Materials 2	4	0
10.022	Engineering Mathematics 2	4	4
29.441	Surveying for Engineers*	6	0
29.491	Survey Camp†	3	0
		17	12

*Includes 28 hours of Saturday fieldwork as an essential part of the subject.

†Students are required to attend a one-week Survey Camp, equivalent to 3 class contact hours per week in a session.

Stage 4			
8.1811	Structural Design 1A	0	3
8.2731	Geotechnical Engineering 1	0	2
8.2733	Rock Engineering	2	0
8.311	Systems Engineering 1	0	2
8.571	Hydraulics 1	3	0
8.671	Engineering Construction	0	3
10.381	Statistics SC	0	2
	Two and a Half General Studies electives**	8	2
		13	14

**See Electives on following page.

Stage 5			
8.173	Structural Analysis 1	0	3
8.1812	Structural Design 1B	3	0
8.1821	Structural Design 2A	0	3
8.2732	Geotechnical Engineering 2	2	0
8.312	Systems Engineering 2	2	0
8.362	Engineering Computations	0	3
8.400	Transport Engineering 1	3	0
8.572	Hydraulics 2	0	3
8.672	Planning & Management 1	4	0
	One Half General Studies elective**	0	2
		14	14

**See Electives on following page.

Stage 6

		Hpw S1	S2
8.174	Structural Analysis 2	3	0
8.1822	Structural Design 2B	3	0
8.191	Structural Engineering	0	3
8.2741	Concrete Technology	4	0
8.2742	Metals Engineering	0	2
8.573	Hydraulics 3	3	0
8.581	Water Resources 1‡	0	3
	Two Technical Electives**	0	6
		13	14

**See Electives below.
‡Includes 8 hours of Saturday fieldwork.

Stage 7

8.001	Industrial Training	0	0
8.051	Design Project—Materials	0	1¼
8.052	Design Project—Structures	1¼	0
8.053	Design Project—Water	0	1¼
8.054	Design Project—Construction	1¼	0
8.401	Transport Engineering 2	3	0
8.582	Water Resources 2	3	0
8.583	Water Resources 3	0	3
8.673	Planning & Management 2	0	3
8.674	Planning & Management 3	3	0
	Three Technical Electives**	3	6
		14½	14½

**See Electives below.

Electives

The requirements of the BE degree course include the completion of five Technical Electives, and three General Studies electives (56 hours each) or the equivalent. Students who have completed General Studies electives on the old basis (42 hours each) will be informed of their General Studies requirement by the School.

Approved Technical Electives are 1.9222 Electronics, 6.832 Industrial Electrical Machinery, 8.039 Computer Programming, 8.040 Advanced Engineering Geology, 36.411 Town Planning, 8.047 History of Civil Engineering, 8.015 Road Engineering, 8.018 Construction Engineering, 8.021 Environmental Aspects of Civil Engineering, 8.023 Hydrodynamics, 8.027 New Materials 1, 8.029 Continuum Mechanics, 8.041 Geological Engineering, 8.081 Probability and Statistics for Civil Engineers, 15.501 Introduction to Industrial Relations.

8.011 Projects, 8.012 Elements of Architecture, 8.013 Bridge Engineering, 8.014 Computer Applications in Civil Engineering, 8.017 Transportation Engineering, 8.019 Railway Engineering, 8.020 Hydrology, 8.024 Foundation and Dam Engineering, 8.025 Structural Failures, 8.026 Systems Methods in Civil Engineering, 8.028 New Materials 2, 8.030 Construction Management, 8.031 Construction Project Finance, 8.032 Construction Law, 8.033 Industrial Law and Arbitration, 8.034 Engineering Economy, 8.038 Special Topics in Reinforced Concrete, 8.042 Water Resources, 8.043 Public Health Engineering, 8.055 Applied Structural Analysis, 8.056 Practical Structural Design, 8.057 Special Topics in Prestressed Concrete, 8.058 Special Topics in Steel Design, 8.059 Structural Vibrations, 8.060 Numerical Methods in Geotechnology, 8.062 Construction Camp, 8.063 River and Coastal Engineering, 8.082 Numerical Methods for Civil Engineers.

Combined Course

3730
Combined Course for BE BSc in Civil Engineering

Students may seek permission to undertake a five-year full-time combined course leading to the award of the degrees of Bachelor of Engineering and Bachelor of Science (BE BSc). The course is administered by the Faculty of Engineering.

Normally, students enrolled in the BE BSc course may be awarded their degrees at the conclusion of five years' study. However, students who commence the course and do not complete the Civil Engineering component may take out a BSc degree on completion of one of the approved programs of the Science and Mathematics Course.

Similarly, students not wishing to complete the BSc degree course may revert to the Civil Engineering program (3620) with appropriate credit for subjects satisfactorily completed.

The combined course consists of the Civil Engineering program (3620), with four instead of eight electives, and at least fourteen units of the Science and Mathematics Course (3970) within an approved program.

There are six approved programs but additional ones may be approved if they are relevant. Approval may be given to change the programs listed below to allow for timetabling and the student's academic interests.

Physical Metallurgy and Chemistry

Year 1

1.981*
2.121
8.1110, 8.1120 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

2.002A, 2.042C, 2.131
4.402, 4.512
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.022
1 General Studies elective†

Year 3

4.403, 4.703
8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
29.441, 29.491
1 General Studies elective†

Year 4

2.003A, 2.003C, 2.013C
4.522
8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 General Studies elective†

Year 5

1 Technical elective†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054

Note: All material not in italic typeface refers to the BE degree component of this combined course.

*****†See footnotes overleaf.

Geography and Environmental Chemistry

Year 1

1.981*
2.121
8.1110, 8.1120, 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

2.002A, 2.002D, 2.042C, 2.131
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.022
27.111

Year 3

2.043A
8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
27.172
29.441, 29.491
1 General Studies elective†

Year 4

8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
27.133, 27.1711, 27.712
2 General Studies electives†
At least 1½ units chosen from:
27.143, 27.183, 27.153, 27.862, 27.863

Year 5

1 Technical Elective†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054

Note: All material not in italic typeface refers to the BE degree component of this combined course.

*****†See footnotes overleaf.

Physics with Mathematics

Year 1

1.001
2.991**
8.1110, 8.1120, 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

1.012
1.022, 1.032
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.113‡, 10.114‡, 10.211‡, 10.2112‡
2 General Studies electives†

Year 3

1.002, 1.023, 1.043
8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
10.111A‡
29.441, 29.491

Year 4

1.0333
Choose 1 unit from: 1.133, 1.3233, 1.0533, 1.0133, 1.0143
8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 General Studies elective†
Choose 2 Level II or Level III Mathematics units from Table 1 in the Sciences Handbook.

Year 5

8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
1 Technical Elective†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.

Note: All material not in italic typeface refers to the BE degree component of this combined course.

‡Students are encouraged to select higher level mathematics units where applicable.

*** ***†See footnotes.

Mathematics

Year 1

1.981*
2.991**
8.1110, 8.1120, 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.111A or 10.121A,
10.1113 or 10.1213,
10.1114 or 10.1214,
10.2111 or 10.2211,
10.2112 or 10.2212
1 General Studies elective†
Choose either **1.** *or* **2.***:*
1. *10.311A or 10.321A,*
10.3111 *or* 10.3211
10.311B or 10.321B
10.3112 *or* 10.3212
2. *Choose 3 units from:*
10.411 or 10.4211
10.4112 or 10.4212
10.331,
10.2113 (or 10.2213) and 10.2115‡ (or 10.2215‡)
10.1111 and 10.1112

Year 3

8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
29.441, 29.491
1 General Studies elective†
Choose 4 units from Mathematics from Table 1 of the Sciences Handbook (at least one must be Level III).

Year 4

8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 General Studies elective†
Choose 3 Level III (not Level II/III) Mathematics units from Table 1 of the Sciences Handbook.

Year 5

8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
1 Technical Elective†
Choose 1 or 2 units from Tables 1 or 3 in the Sciences Handbook at Level II or higher.

Note: All material not in italic typeface refers to the BE degree component of this combined course.

*** ***†See footnotes.

‡If already taken, 10.2114 or 10.2214 are acceptable in place of 10.2115 or 10.2215 respectively.

Geology with some Mathematics

Year 1

1.981*
2.991**
8.1110, 8.1120, 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.111A or 10.121A,
10.1113 or 10.1213,
10.1114 or 10.1214,
10.2111 or 10.2211,
10.2112 or 10.2212
25.110, 25.120
2 General Studies electives†

Year 3

2.042C
8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
25.211, 25.221, 25.212
29.441, 29.491
1 General Studies elective†

Year 4

8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
Choose four units from the following:
25.311, 25.312, 25.314, 25.321, 25.324, 25.325, 25.3261, 25.3271

Year 5

8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
1 Technical Elective†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.

Note: All material not in italic typeface refers to the BE degree component of this combined degree course.
* ** *** †See footnotes below.

Computing with some Mathematics

Year 1

1.981*
2.991**
8.1110, 8.1120. 8.1130, 8.1140
8.1210, 8.1410, 8.1610
10.001***
25.5112

Year 2

6.621, 6.631, 6.641
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.111A or 10.121A,
10.1113 or 10.1213,
10.1114 or 10.1214
2 General Studies electives†

Year 3

6.642, 6.643
8.173, 8.174, 8.1821, 8.1822, 8.311, 8.312, 8.362, 8.400, 8.571
10.381
10.2111 or 10.2211,
10.2112 or 10.2212
29.441, 29.491
Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 4

6.646, 6.647
One of 6.613, 6.632, 6.633
8.2731, 8.2732, 8.2733, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 General Studies elective†
Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 5

8.001, 8.191, 8.2741, 8.2742, 8.401, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
1 Technical Elective†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.

Note: All material not in italic typeface refers to the BE degree component of this combined degree course.

*Students are advised to attempt 1.981 Physics 1CE but if time-tabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt 1.001 Physics 1. On successful completion of this subject students will be exempted from one Technical Elective.

**Students who have not satisfied the Chemistry prerequisite for 2.991 Chemistry 1CE are required to take 2.111 Introductory Chemistry in Session 1 and 2.991 in Session 2.

***Students who have achieved a certain standard may attempt 10.011 Higher Mathematics 1.

†The combined degree program requires one Technical Elective, and three General Studies electives (56 hours each) to be completed. Students who have completed General Studies electives on the old basis (42 hours) will be informed of their General Studies requirements by the School. The Technical Electives are listed after Stage 7 in course 3620. The choice of the Technical Elective must be approved by the Head of the School of Civil Engineering.

School of Electrical Engineering and Computer Science

Head of School
Professor N. W. Rees

Executive Assistant to Head of School
Dr H. S. Blanks

Senior Administrative Officer
Mr K. J. Flynn

Administrative Officer
Ms R. C. Horwood

Electrical Engineering has close links with the pure sciences and mathematics. Its technology is changing rapidly, and the School's teaching and research programs are constantly under review to meet the ever changing challenges of present and future needs.

The School offers undergraduate and graduate training in all branches of the profession of electrical engineering: there are Departments of Communications, Computer Science, Electric Power, Electronics, and Systems and Control Engineering. A number of inter-departmental and specialized groups (such as Digital Systems, Biomedical Engineering, Measurements, Microelectronics, etc.) are also active.

Summary of Courses

Course	Degree(s)	Usual Duration (years)
3640	BE	4 full-time[Note 1] 6 part-time[Note 1]
3650	BSc (Eng)	6 part-time[Note 2]
3720	BE and BA	5 full-time
3725	BE and BSc	5 full-time
3970[Note 3]	BSc (pass) BSc (honours)	3 full-time 4 full-time

Note 1 Course 3640 Full-time/Part-time
A student in course 3640 may with the approval of the Head of School complete the requirements by a combination of full-time and part-time study. To ensure that prerequisites are met and the program can be timetabled, students should consult with the School as early as possible when a change in attendance pattern is envisaged. A part-time student must be able to attend classes one afternoon per week as not all subjects are available in the evenings. From 1985 students commencing the part-time course may be required to attend up to two half-days per week. After Year 1 of the BE, a form of sandwich pattern is possible by arrangement with the Head of School.

Note 2 Course 3650
No new enrolments are being accepted into course 3650. A student already enrolled in this course may complete it and graduate with a BSc (Eng) degree or may request to transfer to course 3640 and graduate with a BE degree.

Note 3 Course 3970
This course is operated by the Board of Studies in Science and Mathematics and is for students wishing to major in Computer Science in a Science and Mathematics context. For more details see the Sciences Handbook. Most of the course is available in evening classes but some day attendance is essential in Year 3.

The undergraduate curriculums are being progressively revised to provide a flexible training to suit the needs of today and tomorrow. Individual student needs can be further met by quite extensive substitution provisions within the course programs.

Recognition

The degrees of Bachelor of Engineering and Bachelor of Science (Engineering) are recognized by the Institution of Engineers, Australia and the Institution of Radio and Electronics Engineers, Australia, as meeting the examination requirements for admission to graduate and corporate membership.

Honours

In the Bachelor of Engineering Course the same formal program is offered to both pass students and to those aiming at honours. Honours will be awarded for meritorious performance over the course; special attention is paid to a candidate's performance in the final year thesis project. A student with a creditable performance in the Bachelor of Science (Engineering) course may be awarded a degree with Merit.

The award of the BA or BSc degree at honours level requires two additional sessions of study. See the Arts and Sciences Handbooks for details.

Substitution of Subjects

To suit the special abilities or needs of individual students a limited amount of substitution is permitted within each course. Any such substitution *must have prior approval of the Head of School* who will ensure that:
1. The replacement subject is at least the same length and level as the prescribed subject it replaced; and,
2. The resulting overall program of study is suited to the award of the degree as applicable.
Substitution is not permitted in Year 1.

Examples
(i) Replacement of General Studies subjects by subjects approved (by the Head of the Department of General Studies) selected from areas such as Arts; Life Sciences; Earth Sciences; Accounting and Business Administration; Law; Economics; Industrial Management.

(ii) The normal Year 4 of the BE degree program includes 5 units of Electrical Engineering IV. Students may substitute for *one* of these units, a subject of suitable level and difficulty from an area outside the School of Electrical Engineering and Computer Science. A graduate subject of the School may also be substituted in this way.

(iii) Part-time BE students in full-time employment may request substitution of Industrial Electives (6.931, 6.932, 6.933) for up to three subjects in the BE course. See Industrial Elective subject descriptions for details.

Course Rules

It is the responsibility of students to meet the course requirements applicable at the date of application for the degree.

- Programs and timetables are arranged in preferred year or stage groupings. Progression is, however, by subject.

- In addition to the specific subject prerequisites a general understanding of the material in the preceding Year or Stage is assumed. Students are not normally permitted to enrol in subjects spread beyond two Years or Stages.

- Students who do not pass their full programs will be limited to 80% of a normal load in the following year.

- Previously failed subjects must be included, except that a failed elective may be replaced by another elective.

Course Revision

Following each course revision students are assessed on the basis of the new program but retain credit for any subject already completed and are not liable for the increased requirements if progression is normal.

It is the responsibility of students to enrol in a program consistent with the rules governing re-enrolment and admission to the degree.

Re-enrolment

Students must collect enrolment information from the School Office before the end of Session 2. Re-enrolment forms, giving details of students' proposed 1985 programs must be lodged with the School Office by the end of the first week in January. Enrolment at the University will not be authorized until the re-enrolment form has been checked and the program approved. Students not intending to re-enrol should advise the School. Leave of absence for up to one year is usually granted to students in good standing.

3640
Electrical Engineering — Full-time Course

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.961	Physics 1*	6	6
2.121	Chemistry	6	0
5.006	Engineering E	6	0
6.010	Electrical Engineering 1	0	6
6.611	Computing 1	0	6
10.001	Mathematics 1*	6	6
	General Studies elective	2	2
		26	26

*Students who have achieved a certain standard may attempt similar material at a higher level.

Year 2†

1.972	Electromagnetism	0	4
1.982	Solid State Physics	4½	0
10.111A	Pure Mathematics 2 (Linear Algebra)*	2½	2½
10.1113	Pure Mathematics 2 — Multivariable Calculus*	2½	0
10.1114	Pure Mathematics 2 — Complex Analysis*	0	2½
10.2111	Applied Mathematics 2 — Vector Calculus*	2½	0
10.2112	Applied Mathematics 2 — Mathematical Methods for Differential Equations*	0	2½
	General Studies elective	4	0
Electrical Engineering II			
6.021A	Circuit Theory 1	4	0
6.021B	Power	0	4
6.021C	Electronics 1	0	4
6.021D	Computing	4	0
6.021E	Digital Logic and Systems	0	4
		24	23½

†Students who plan to specialize in Computer Science or Physics in a BE/BSc course should consult the School before enrolling in Year 2.

*Students who have achieved a certain standard may attempt similar material at a higher level.

Year 3*

		Hpw S1	S2
10.0331	E. E. Mathematics 3 — Transform Methods	2	0
10.0332	E. E. Mathematics 3 — Numerical Methods	0	2
10.361	Statistics SE	2	2
	General Studies elective	4	0
	Technical Elective†	0	4
Electrical Engineering III			
6.0311	Circuit Theory II	4	0
6.0312	Utilization of Electric Energy	4	0
6.0313	Electronics II	4	0
6.0314	Systems and Control I	0	4
6.0315	Electrical Energy	0	4
6.0316	Electronics III	0	4
6.0317	Communications Systems I	0	4
6.0318	Microprocessor Systems and Applications	4	0
		24	24

*Students who intend to major in particular disciplines should note that certain subjects are prerequisites for the Professional Electives they choose in Year 4.

†See list of Technical Electives later this section.

Year 4

	General Studies elective†	4	0
	Technical Elective	4	0
Electrical Engineering IV			
	5 Professional Electives*	15	10
6.911	Thesis**	2	21
6.903	Industrial Training‡	—	—
		25	31

*Three electives are taken in Session 1 and two in Session 2. See list of Professional Electives later this section.

†Students are required to complete 168 hours of General Studies electives for the BE degree. If these have been completed by Year 4, no General Studies subject is required in that year's program.

**6.911 Thesis is done in the last two sessions of a student's course. See subject description.

‡All students in the BE degree course must complete at least 60 days industrial experience.

3640
Electrical Engineering — Part-time Course

Bachelor of Engineering
BE

Compared with the full-time program above, subjects 10.0331, 10.0332, one Technical Elective and one Professional Elective are assumed to have been substituted by three Industrial Electives (see Industrial Elective subject description for more details). Other subjects could be replaced in lieu of those above with approval of the Head of School.

Stage 1

		Hours per week S1	S2
1.001	Physics 1	6	6
10.001	Mathematics 1	6	6
5.006	Engineering E (or equivalent)	3	3
		15	15

Stage 2

2.121	Chemistry	6	0
6.010	Electrical Engineering 1	0	6
6.021A	Circuit Theory 1	0	4
6.611	Computing 1	6	0
10.2111	Applied Mathematics 2 — Vector Calculus	0	2½
10.2112	Applied Mathematics 2 — Mathematical Methods for Differential Equations	2½	0
		14½	12½

Stage 3*

1.972	Electromagnetism	4	0
1.982	Solid State Physics	0	4½
6.021B	Power	4	0
6.021D	Computing	0	4
10.111A	Pure Mathematics 2 — Linear Algebra	2½	2½
10.1113	Pure Mathematics 2 — Multivariable Calculus	0	2½
10.1114	Pure Mathematics 2 — Complex Analysis	2½	0
	General Studies elective	2	2
	Industrial Elective		
		15	15½

Stage 4*

6.021C	Electronics 1	4	0
6.021E	Digital Logic and Systems	4	0
6.0311	Circuit Theory 2	0	4
6.0312	Utilization of Electrical Energy	0	4
6.0313	Electronics 2	0	4
	Technical Elective†	5	0
	General Studies elective	2	2
	Industrial Elective		
		15	14

Stage 5*

6.0314	Systems and Control 1	4	0
6.0315	Electrical Energy	0	4
6.0316	Electronics 3	4	0
6.0317	Communication Systems 1	0	4
6.0318	Microprocessor Systems and Applications	0	4
10.361	Statistics SE	2	2
	Industrial Elective		
		10	14

Stage 6

		Hpw S1	S2
	General Studies elective	2	2
	Four Professional Electives‡	10	10
6.903	Industrial Training**		
6.911	Thesis††		
		12	12

*Students who intend to major in particular disciplines should note that certain subjects are prerequisites for the Professional Electives they choose in Stage 6.

†See list of Technical Electives later this Section.

‡Two electives are taken in each session. See list of Professional Electives later this section.

**All students in the BE degree course must complete at least 60 days industrial experience.

††6.911 is done in the last two sessions of a student's course. See subject description.

3650 Electrical Engineering

Bachelor of Science (Engineering) BSc(Eng)

Please note that from 1983, no new enrolments are being accepted into the BSc(Eng) degree course.

Stage 1

		Hours per week S1	S2
1.001	Physics 1	6	6
10.001	Mathematics 1	6	6
		12	12

Stage 2

2.121	Chemistry	6	0
6.010	Electrical Engineering 1	0	6
6.021A	Circuit Theory 1	0	4
6.611	Computing 1	6	0
10.2111	Applied Mathematics 2 — Vector Calculus	0	2½
10.2112	Applied Mathematics 2 — Mathematical Methods for Differential Equations	2½	0
		14½	12½

Stage 3

		Hpw S1	S2
1.972	Electromagnetism	4	0
1.982	Solid State Physics	0	4½
6.021B	Power	4	0
6.021D	Computing	0	4
10.111A	Pure Mathematics 2 — Linear Algebra	2½	2½
10.1113	Pure Mathematics 2 — Multivariable Calculus	0	2½
10.1114	Pure Mathematics 2 — Complex Analysis	2½	0
	General Studies elective	2	2
		15	15½

Stage 4

6.021C	Electronics 1	4	0
6.021E	Digital Logic and Systems	4	0
6.0311	Circuit Theory 2	0	4
6.0312	Utilization of Electrical Energy	0	4
6.0313	Electronics 2	0	4
	Technical Elective†	5	0
	General Studies elective	2	2
		15	14

†See list of Technical Electives later this section.

Stage 5

6.0314	Systems and Control 1	4	0
6.0315	Electrical Energy	0	4
6.0316	Electronics 3	4	0
6.0317	Communications Systems 1	0	4
6.0318	Microprocessor Systems and Applications*	0	4
10.361	Statistics SE	2	2
		10	14

*Not required for students who have completed Stage 4 by the end of 1982.

Stage 6

	General Studies elective	2	2
	Four Professional Electives††	10	10
6.902	Industrial Experience‡		
6.921	Project**		

††Two electives are taken each session. See list later this section.

‡Students in the BSc(Eng) degree course must complete three years of concurrent appropriate industrial experience.

**Students enrol in the Project in the final stage of their course. See subject description.

†Technical Electives available in 1985

		Hpw S1		S2
1.992	Mechanics and Thermal Physics	2		2
4.964	Materials Science and Engineering for Electrical Engineers	0		4
5.056	Mechanical Engineering	0		4
6.402	Introductory Physiology for Engineers	4		0
6.641	Computing 2C	5	*or*	5
8.6120	Civil Engineering	4		0
18.091	Industrial Management	5		0
48.302	Fuels and Energy	0		4

A free choice may not be possible.

††Electrical Engineering Professional Electives

Each elective is 5 hours per week for one session.

The list of electives is*:

6.041	Electrical Measurements
6.042	Digital and Analogue Signals
6.044	Electrical Product Design and Reliability
6.202	Power Engineering 1
6.203	Power Engineering 2
6.212	Power Engineering — Utilization
6.222	High Voltage Technology
6.303	Transmission Lines for Microwave and Optical Communication
6.313	Signal Propagation at Microwave and Optical Frequencies
6.322	Electronics 4
6.323	Communication Systems 2A
6.333	Communication Systems 2B
6.412	Systems and Control 2
6.413	Digital Control
6.432	Computer Control and Instrumentation
6.483	Biomedical Engineering
6.512	Semiconductor Devices
6.522	Transistor and Integrated Circuit Design
6.532	Integrated Digital Systems
6.612	Computer Organization and Architecture
6.622	Computer Applications
6.652	Data Communication and Computer Networks
6.672	Operating Systems and Compilers

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 to part-time students. Students are advised each year of the timetable of available electives.

*Students who have completed the prerequisites may request substitution of approved Science III Computing Science electives.

Prerequisites and Co-requisites
Arranged in order of full-time Bachelor of Engineering Degree Course

Year	Subject	Prerequisites	Co-requisites
1	1.961		
	2.121	See Matriculation and Admission Requirements	
	5.006	See Matriculation and Admission Requirements	
	6.010	The Electricity & Magnetism section of 1.961	
	6.611		10.001
	10.001	See Matriculation and Admission Requirements	
2	1.972		
	1.982	1.961, 10.001	10.2111, 10.2112
	6.021A	1.961, 6.010, 10.001	
	6.021B	6.021A**	
	6.021C	6.021A, 1.982‡	
	6.021D	6.611	
	6.021E	10.001	
	10.111A	10.001	
	10.1113	10.001	
	10.1114	10.001	
	10.2111	10.001	
	10.2112	10.001	
3	1.992	1.961, 10.001	10.2111, 10.2112
	4.964	1.982	
	5.056	10.2111, 10.2112, 1.961	
	10.0331	10.111A, 10.1113, 10.1114, 10.2112	
	10.0332	10.111A, 10.1113, 10.1114, 10.2111, 10.2112	
	10.361	10.001	
	6.0311	6.021A, 6.021B, 6.021C†, 10.111A**, 10.1113, 10.1114, 10.2111, 10.2112*	
	6.0312	6.021A, 6.021B	6.0311
	6.0313	6.021A, 6.021C	6.0311
	6.0314	6.0311	
	6.0315	1.972, 6.0312**	
	6.0316	6.0313	6.021E, 6.0311
	6.0317	6.0311	10.361
	6.0318	6.021D, 6.021E, 6.021C**	
	6.641	6.021D††	
4	18.091	10.2112, 10.361**	
	6.041	6.0311, 6.0313	
	6.042	10.0331 *or* 10.033, 10.361, 6.0311	
	6.044	10.361	
	6.202	6.0312, 6.0315	
	6.203	6.202	
	6.212	6.0312, 6.0315	
	6.222	6.0315	
	6.303	6.0317	
	6.313	6.303‡‡	
	6.322	6.0313, 6.0316	
	6.323	6.0317††, 10.033, 10.361	
	6.333	6.0316, 6.0317	
	6.412	6.0311, 6.0314	
	6.413	6.0314††, 10.033 or 10.0331, 10.361	
	6.432	6.0314, 6.0316, 6.0318††	
	6.483	6.402	
	6.512	6.0313	
	6.522	6.0313, 6.0316	
	6.532	6.021E, 6.0316	
	6.612	6.0318 *or* 6.613	
	6.622	6.641	
	6.652	6.0318 *or* 6.613, 6.0317	
	6.672	6.0318 *or* 6.613, 6.641	
	6.911	(in graduating program only)	

*Two of 10.1113, 10.1114, 10.2111, *or* 10.2112 may be taken as co-requisites.
**Attempted at an acceptable level and to be taken as a co-requisite.
†One of 6.021B or 6.021C may be taken as a co-requisite.
††Pass Conceded (PC) awarded prior to Session 2, 1983 is not acceptable.
‡One of 6.021A or 1.982 to be passed, the other to be attempted at an acceptable level and to be repeated concurrently.
‡‡May be taken as a co-requisite.

Combined Courses

Students in Electrical Engineering who maintain a creditable performance may qualify for the award of two degrees in five years of combined full-time study in which the requirements of the degrees have been merged. (The two degrees referred to here are the Bachelor of Engineering/Bachelor of Science BE BSc and the Bachelor of Engineering/Bachelor of Arts BE BA.) Students wishing to enrol in a combined course may do so only on the recommendation of the Head of School of Electrical Engineering and Computer Science and with the approval of the Faculty of Engineering and either the Faculty of Arts or the Board of Studies in Science and Mathematics, as appropriate. Students wishing to enrol in, transfer into, or continue in a combined course shall have complied with all the requirements for prerequisite study, sequencing and academic attainment (a creditable performance, ie 65% average) of both the Course Authorities concerned.

Students who commence a course but subsequently do not wish to proceed with both areas of study, or who fail to maintain a creditable performance, revert to a single degree program with appropriate credit for subjects completed. Tertiary Education Assistance Scheme (TEAS) support is available for the five years of the combined degree courses.

Students may transfer into a combined course after partially completing the requirements for either degree provided suitable subjects have been studied. However, the choice of subjects and the time taken to complete the program can be seriously affected by this. Thus, students considering course **3725** or course **3720** should contact the Electrical Engineering School before completing their Year 2 enrolment. Application for transfer to a combined course must be made in writing to the Head of School by the end of the first week of January in the year they will commence Year 3 of the BE course.

Students wishing to gain a degree at honours level in Arts or Science as part of their combined degree program shall meet all the relevant requirements of the Faculty concerned and of the appropriate Schools. Such students may enrol for the Honours year only on the recommendation of the Head of School of Electrical Engineering and Computer Science and with the approval of the Faculty of Engineering and either the Faculty of Arts or the Board of Studies in Science and Mathematics, as appropriate.

Re-enrolment of students in Courses **3720** and **3725** each year is arranged by the School of Electrical Engineering and Computer Science.

3725
BE BSc in Electrical Engineering

Having completed Years 1 and 2 of course **3640** students in their third year complete a specific course of study consisting of four Level III Science units chosen from related disciplines, the appropriate General Studies electives and no less than four other Level II or Level III units, and otherwise accord with the rules of course **3970** leading to a major in Computer Science, Mathematics or Physics.

Students may open up a wider choice of subjects in their Science Year by including additional Computer Science (viz 6.641), Physics (viz 1.992) or Mathematics in their Year 2 Electrical Engineering program. Any subject omitted may be required to be taken later in the course. The extra subject in Year 2 may be credited towards either the BE or BSc requirements, but not both.

In their fourth and fifth years the students do Year 3 and Year 4 of course **3640**. Depending on the program followed in their year of Science they may have already completed parts of the normal third and fourth year programs of the Electrical Engineering course, and they will be required to omit these from their program and to include an equivalent amount of other courses chosen with the approval of the Head of School.

3720
BE BA in Electrical Engineering

The combined course should include

- the requirements of a normal BE program in Electrical Engineering less the General Studies subjects and *one* other subject approved by the Head of the School;

- subjects equivalent to 108 credit points in accordance with the regulations of the Faculty of Arts provided that this includes a major sequence of subjects available within the Faculty of Arts in addition to the studies in the School of Mathematics and the Department of Computer Science. These include the subjects in **Table A** or their equivalents.

Table A		Credit Points
10.001	Mathematics 1	12
10.111A	Pure Mathematics 2	4
10.1113	Pure Mathematics 2	2
10.1114	Pure Mathematics 2	2
10.2111	Applied Mathematics 2	2
10.2112	Applied Mathematics 2	2
10.361	Statistics SE	2
1.961	Physics 1	12
1.972	Electromagnetism	4
1.982	Solid-State Physics	4
6.021D	Computing	4
6.021E	Digital Logic and Systems	4
		54

Guidance should be sought from the School of Electrical Engineering and Computer Science, the relevant schools in the Faculty of Arts and the Arts Faculty office. After four years of study a student will normally have completed the BA requirements of study, together with subjects selected from course **3640** (in accord with an acceptable program loading) and in the fifth year will complete requirements for a BE.

It is necessary for each individual student entering the course to lodge for approval a complete program of study: changes in detail are usual from year to year. Students should choose their Arts Major early so as to start the sequence in Year 1 if possible.

Studies in Computer Science *other than* in BE Course 3640, BE BA 3720 and BE BSc 3725

Minor Study in BA Course 3400 or BSc course 3970

Some students will wish to include a small number of Computer Science units in courses leading to major studies in other disciplines. Level I unit 6.611 and Level II units 6.621, 6.631, 6.641 are freely available to such students.

Students majoring in other disciplines may also seek entry, on a competitive merit basis, to a limited range of Level III units.

Major Study in BA Course 3400 or BSc course 3970

For studies in Computer Science to be regarded as being major studies, at least four Level III units of Computer Science must be included after completing Level I unit 6.611 and the three Level II units, 6.621, 6.631, 6.641.

Course 3400

For further details of major studies in Computer Science within the Bachelor of Arts degree course, please see the Arts Faculty Handbook.

Course 3970

Entry to a Computer Science major in course **3970** is normally by direct selection at University entry.

Year 1 students in course **3970** who are not selected for direct entry into a Computer Science major must enrol in program 6806. For such students enrolment in Year 2 of a Computer Science program is based on academic performance in Year 1; however, transfers are possible only if places are available.

A total of 23 units is required for graduation at the pass level.

Year 1
6.611
10.001 (*or* 10.011)
5 other Level I units
*1 General Studies elective**

Year 2
6.621
6.631
6.641
5 other Level II units
1 General Studies elective

Year 3
4 Computer Science Level III units
3 other Level II *or* Level III units
1 General Studies elective
Students intending to proceed to Honours should choose:
8 Level III units including
6.613, 6.632, 6.642 and 6.643

Year 4
6.606

*Enrolment in General Studies may be deferred until later years but three electives must be satisfactorily completed for degree requirements.

For further details see Sciences Handbook.

Computer Science Electives offered by the School

No.	Name	Level	Prerequisites	Co-requisites	Excluded
6.611	Computing 1	I	As for 10.001	10.001 *or* 10.011	6.600 6.620 6.021D
6.621	Computing 2A	II	6.611* *and* 10.001 *or* 10.011		6.620 6.021D
6.631	Computing 2B	II	6.620†* *or* 6.021D* *or* 6.621*		6.021E
6.641	Computing 2C	II	6.620†* *or* 6.021D* *or* 6.621*		
6.613	Computer Organization and Design	III	6.631* *or* 6.021E*, 6.021D* *or* 6.620* *or* 6.621*		6.0318
6.632	Operating Systems	III	6.631* *or* 6.021E*, 6.641*		6.672
6.633	Data Bases and Networks	III	6.641*		14.607, 14.608, 6.622, 6.652
6.642	Design and Analysis of Algorithms	III	6.641*		
6.643	Compiling Techniques and Programming Languages	III	6.641*		6.672
6.646	Computer Applications	III	6.620†* *or* 6.021D* *or* 6.621*, one of 10.311A, 10.321A, 10.301, 10.331, 45.101 or equivalent		6.622
6.647	Business Information Systems	III	6.641*, 14.501		14.603 14.602 14.605
6.649	Computing Practice††	III	6.641*	6.633 *or* 6.643 *or* 6.647	

*Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable.
†Students who have completed 6.600 at a grade of Credit or better may be permitted to undertake this subject.
††Can only be counted with at least 3 other Computer Science Level III subjects.

School of Mechanical and Industrial Engineering*

Incorporating Aeronautical Engineering and Naval Architecture

Head of School
Professor R. A. A. Bryant

Executive Assistant to Head of School
Dr J. E. Baker

Senior Administrative Officer
Mr G. Dusan

The School of Mechanical and Industrial Engineering offers courses in **Aeronautical Engineering, Industrial Engineering, Mechanical Engineering** and **Naval Architecture**, either singly or in combination with Science or Arts courses.

The courses are planned to provide the appropriate academic training for the professional engineer in the fields of aeronautical, industrial and mechanical engineering, and for the naval architect. They may be taken on a full-time basis, normally over four years, or on a combined full-time/part-time basis. The equivalent of the first two full-time years may be taken by wholly part-time study. Part-time students will normally take two years for each equivalent full-time year and will be required to attend day classes for the equivalent of at least 1½ days per week. Students intending to enter part-time study are advised that most subjects in the later years of the course are only offered in the day-time.

The courses lead to the award of the degree of Bachelor of Engineering (BE).

The School also offers combined courses in conjunction with other faculties of the University leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc) or Bachelor of Engineering and Bachelor of Arts (BE BA). These combined courses enable students to major in the area of computer science, materials science, mathematics, physics, statistics or another relevant field in addition to studying their chosen engineering speciality.

For the four BE courses, the study of the basic sciences — mathematics, physics and chemistry — together with an introduction to engineering, comprise Year 1. In Year 2 further mathematical studies are undertaken, together with a study of the engineering sciences — thermodynamics, fluid mechanics, engineering mechanics, mechanics of solids — and their application in the field of design.

The first halves of the courses of Mechanical, Industrial and Aeronautical Engineering and of Naval Architecture are identical, and students attend classes together. The latter halves of these four courses contain a number of common core subjects together with specific departmental requirements. In the final years, in addition to core subjects and departmental requirements, provision is made for a limited degree of specialization in one or more elective subjects. Students may take, subject to the approval of the Head of School, a limited number of graduate subjects offered by the School in lieu of an equivalent quantity of final year undergraduate electives. Each student is required to present a thesis at the end of the final year and to deliver a short paper on the subject of the thesis. General Studies form a regular part of all courses. In certain instances and with permission from the Head of School students may substitute an Arts subject in lieu of two General Studies subjects.

Industrial experience is an integral part of the courses. Full-time students must complete forty working days of approved industrial training between both Years 2 and 3 and Years 3 and 4. Students are strongly recommended to gain as much industrial training as possible between Years 1 and 2.

Students taking the course on a full-time/part-time basis must complete an equivalent amount of industrial training.

Students who have had suitable industrial experience may qualify for exemption from certain subjects. The Head of School should be contacted for details.

All BE degree course students are considered for the award of Honours which is granted for meritorious performance in the course with particular emphasis on the later years. Honours in Science or Arts in the BE BSc or BE BA combined degree course require an extra year of study.

The Institution of Engineers, Australia, recognizes the degree of BE in any of the undergraduate courses offered by the School as meeting the examination requirements for admission to graduate and corporate membership.

The award of the degree BE in Aeronautical Engineering is recognized by the Royal Aeronautical Society as giving exemption from the formal examination requirements for corporate membership. Advancement from graduate membership to associate membership grade is awarded on a case by case basis after a further period of some years of professional experience.

The award of the degree BE in Naval Architecture is recognized by the Royal Institution of Naval Architects (RINA), London, as the academic qualification for corporate membership of that body.

Course Progression Guidelines

It is the responsibility of each student to have met the course requirements by the date of application for the degree. In this context, the student's attention is directed to the Faculty's General Rules for Progression contained in the preceding chapter of this Handbook. As well, the following points should be noted.

- Progression in the School's courses is by subject, although programs and timetables are arranged by year.
- In addition to the specific subject prerequisites for a particular year of a course, a general understanding of the material in the preceding year is assumed.
- Previously failed subjects must be included in a student's current program, except that a failed elective may be replaced by another elective.
- A student who is faced with compiling a mixed year's program must give preference to subjects from the lower year of the course.
- In the event of a student's dropping one or more subjects from a mixed year's program, the discarded subject(s) must be chosen from the higher year's selection.

3680
Mechanical Engineering — Full-time Course

Bachelor of Engineering
BE

Note: The program as presented is for full-time study. Alternative programs are available for part-time, or for a combination of full-time and part-time study. Students wishing to commence studies on a part-time basis must, in Year 1, study the subjects: 1.951, 2.951, 5.010, 10.001.

Year 1		**Hours per week** S1	S2
1.951	Physics 1 (Mechanical Engineering)	4	4
2.951	Chemistry 1ME	0	6
5.010	Engineering A	6	0
5.030	Engineering C (Production Technology Option)	3	3
5.0303	Workshop Technology	3	0
5.061	Technical Orientation	2	0
5.0721	Computing	2	0
5.421	Mechanics of Solids	0	4
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		26	23

An alternative 'Science/Arts compatible' course which can be undertaken by all students and which must be undertaken by potential combined degree students, is as follows.

		Hpw S1	Hpw S2
1.001	Physics 1	6	6
2.121	Chemistry 1A* *or*	0	6
2.951	Chemistry 1ME*		
5.010	Engineering A	6	0
5.0201	Engineering Dynamics 1A†	0	3
5.421	Mechanics of Solids**	0	4
	‡		
5.030	Engineering C (Production Technology Option)	3	3
5.0303	Workshop Technology	3	0
5.061	Technical Orientation	2	0
5.0721	Computing	2	0
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1		
		28	28

*Students are recommended to choose 2.951 unless they wish to pursue studies requiring 2.121. For combined degree course students, the prerequisite of 2.121 for 2.002A Physical Chemistry may be waived on application to the Head of the School of Chemistry. Materials Science (Option 1) majors must choose 2.121.

†Students planning to take higher level Computer Science subjects should take 6.611 Computing I or 8.360 Computing instead of 5.0201 which must then be taken in a subsequent year prior to taking 5.300.

**Recommended. Students may substitute 8.171 Mechanics of Solids 1.

‡Students taking 5.0201 and 5.421 (or 8.171) may enrol in subject 5.020 as an equivalent.

Year 2

		Hpw S1	Hpw S2
5.0201	Engineering Dynamics 1A	3	0
10.351	Statistics SM	2	2
5.122	Mechanical Engineering Design 2	3	3
5.300	Engineering Dynamics 1B	0	2
5.422	Mechanics of Solids 2/ Materials	4½	4½
5.622	Fluid Mechanics/ Thermodynamics	4	4
10.022	Engineering Mathematics 2**	4	4
18.020	Industrial Orientation	0	1
	General Studies elective	2	2
		22½	22½

Year 3

		Hpw S1	Hpw S2
5.034	Engineering Experimentation	1½	2
5.043	Industrial Training 1*	0	0
5.073†	Numerical Analysis/Mathematics	3	3
5.123	Mechanical Engineering Design 3	3	3
5.333	Dynamics of Machines	0	3
5.343‡	Linear Systems Analysis	3	0
5.423	Mechanics of Solids 3	2	2
	Two Fluid Mechanics/ Thermodynamics Technical Electives	3	3
6.854	Electrical Engineering	0	3
6.856	Electronics for Measurement and Control	3	0
18.603	Management/Economics	2	2
	General Studies elective	2	2
		22½	23

**Students may substitute 10.111A, 10.1113, 10.2111 and 10.2112 for 10.022. Also, if they satisfy pre-requisites, they may take one or more of these at the higher level.

*Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.

†Combined degree course students who have taken 10.1114 Complex Analysis should substitute 18.803 Optimization for the mathematics portion of this subject; if they have in addition taken 10.2113 Introduction to Linear Programming, they should substitute instead of 18.803 a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Faculty Handbook. Combined degree course students who have taken 10.211E Numerical Methods or 10.212A (or 10.222A) Numerical Analysis should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Faculty Handbook for the Numerical Analysis portion of this subject.

‡Combined degree course students who have taken 10.212M (or 10.222M) Optimal Control Theory should substitute a Technical Elective or a half Level II or III unit from Table 1 of the Combined Sciences Handbook.

Year 4

		Hpw S1	Hpw S2
5.044	Industrial Training 2	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.344	Feedback Control	3	0
	Technical Electives	9	12
	General Studies elective	2	2
		22	22

Note 1: At least six hours per week of Technical Electives must be taken from the Mechanical Engineering Technical Elective list. The remaining Technical Electives may be taken from the Industrial Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School. Students with good academic records may include some graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.

Note 2: Only a limited number of Technical Electives is offered each year. The actual Technical Electives offered each year are decided on the basis of staff availability and student demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

Mechanical Engineering Technical Electives

Applied Dynamics

		Hours per week S1		S2
5.332	Dynamics of Machines 2	3		3
5.334	Engineering Dynamics 2	3	*or*	3
5.345G	Analogue Control Systems	0		3
5.3541	Engineering Noise 1	3		0
5.3542	Engineering Noise 2	0		3

Mechanics of Solids

5.414G	Finite Element Applications	3	*or*	3
5.424	General Mechanics of Solids	3	*or*	3
5.434	Plates and Shells	3	*or*	3
5.444	Theory of Elasticity	3	*or*	3
5.454	Theory of Plasticity	3	*or*	3
5.464	Structural Instability	2		0

Mechanical Design

5.124	Mechanical Engineering Design 4	6		6
5.1241	Creative Design Project	3		0
5.1242	Design Technology	3		0
5.1243	Machinery Design Project	0		3
5.1244	Design Management	0		3
5.1245	Computer-Based Engineering Design	0		3

Fluid Mechanics/Thermodynamics

5.623	Heat Transfer	3	*or*	3
5.624	Refrigeration and Air Conditioning	3	*or*	3
5.633	Turbomachines	3	*or*	3
5.6341	Viscous Flow Theory	1½		1½
5.6342	Lubrication	0		3
5.635	Convection Heat Transfer	3	*or*	3
5.643	Classical Thermodynamics and Combustion	3	*or*	3
5.644	Solar Energy	3	*or*	3
5.653	Compressible Flow	3	*or*	3
5.654	Hydraulic Transients	3	*or*	3
5.663	Potential Flow Theory*	3	*or*	3
5.664	Multiphase Flow	3	*or*	3
5.673	Special Fluid Mechanics Elective	3	*or*	3
5.674	Special Thermodynamics	3	*or*	3

*Excluded: 5.811 Aerodynamics 1.

Industrial Engineering

		Hpw S1		S2
18.004	Manufacturing Management	2		2
18.224	Numerical Control of Machine Tools	3	*or*	3
18.303	Methods Engineering	2		2
18.403	Production Design and Technology	4		4
18.404	Design for Production	2		2
18.503	Operations Research A	3		3
18.551	Operations Research	3		3
18.803	Optimization	3		0
18.874G	Dynamic Programming	1		1

Other Technical Electives

4.913	Materials Science	3		3
5.074	Computing Science for Mechanical Engineers	3		0
5.811	Aerodynamics 1†	3		3
5.831	Aircraft Propulsion	2		2
23.051	Nuclear Power Technology	3		3

†Excluded: 5.663 Potential Flow Theory.

Note: The graduate subjects listed should be of particular interest to undergraduate students; with approval, other graduate subjects from this and other Schools may be taken.

3681
Mechanical Engineering — Combined Course

Bachelor of Engineering/Bachelor of Science BE BSc

The combined degree course of five years full-time study enables a student in the School of Mechanical and Industrial 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 computer science, materials science, mathematics, physics or statistics. It is administered by the Faculty of Engineering.

All students who are accepted into the Year 1 'Science/Arts compatible' course in the School of Mechanical and Industrial Engineering may enrol directly into this course. Continued enrolment in Year 2 requires a pass at first attempt in all subjects of Year 1 and students who fail to achieve this will automatically be transferred to the normal Engineering program. Alternatively, students may transfer into the Year 2 of this course, provided they have obtained a pass at first attempt in the Year 1 'Science/Arts compatible' course.

Normally, students enrolled in this BE BSc degree course are awarded their degrees at the conclusion of five years study. However, it is possible for students to take out the Science degree prior to the Engineering degree provided they have:
1. completed the requirements for Years 1, 2 and 3,

2. completed the General Studies requirements for the Science degree, and **3.** obtained approval from the Board of Studies in Science and Mathematics.

Students may also undertake an additional honours year in Science and Mathematics and automatically re-enter this course without having to re-apply for admission. To undertake such an honours year in Science and Mathematics, permission is to be obtained at the end of Year 3 both from the Head of the School in which the honours year is to be undertaken and from the Head of the School of Mechanical and Industrial Engineering.

Students who commence the course and do not complete the Engineering component may take out a BSc degree on completion of one of the approved programs in the Science and Mathematics course. Similarly, students not wishing to complete the BSc degree course may revert to the normal Engineering program with appropriate credit for subjects satisfactorily completed.

Year 1 of the combined course is equivalent to the Year 1 'Science/Arts compatible' course in the School of Mechanical and Industrial Engineering, and is as detailed in course 3680 Mechanical Engineering. Having completed Years 2 and 3, as outlined below, students in Years 4 and 5 do Year 3 and Year 4 of their selected Engineering course except that significant repetition of subject material is not allowed. Instead, students are required to substitute either an appropriate Technical Elective or an appropriate Level II or III subject from Table 1* or Table 2*, or in exceptional circumstances, some other equivalent subject with the permission of the Head of the School of Mechanical and Industrial Engineering.

*Tables refer to the Combined Sciences Handbook.

Year 2[4,15]		**Hours per week** S1	S2
5.300	Engineering Dynamics 1B[1]	0	2
5.422	Mechanics of Solids 2/ Materials[5]	4½	4½
10.111A	Pure Mathematics 2 — Linear Algebra	2½	2½
10.1113	Pure Mathematics 2 — Multivariable Calculus	2½	0
10.1114	Pure Mathematics 2 — Complex Analysis	0	2½
10.2111	Applied Mathematics 2 — Vector Calculus	2½	0
10.2112	Applied Mathematics 2 — Mathematical Methods for Differential Equations	0	2½
18.020	Industrial Orientation	0	1
	4 appropriate units from Table 1* or Table 2* for course 3681[2]	8+	8+
		22+	23+

		Hpw S1	S2
Year 3			
5.043	Industrial Training 1	0	0
5.122	Mechanical Engineering Design 2	3	3
5.622	Fluid Mechanics/ Thermodynamics	4	4
	5 appropriate units from Table 1* or Table 2* for course 3681[2].	10+	10+
	General Studies elective[6].	2	2
		19+	19+

Subject selections which satisfy the specific requirements for the various majors are summarized below. Provided co- and prerequisites are satisfied, there is scope for some subjects to be taken either in Year 2 or Year 3.

Computer Science Majors[13].

Year 2
5.0201, 5.300, 5.422
6.621, 6.631[7], 6.641
10.111A (*or* 10.121A), 10.1113 (*or* 10.1213), 10.1114 (*or* 10.1214), 10.2111 (*or* 10.2211), 10.2112 (*or* 10.2212), 10.331
18.020

Year 3
1.002 *or* 1.012 *or* 1.022 *or* 2.002A[3].
5.043, 5.122, 5.622
4 Level III units from Table 1* and Table 2* offerings of School of Electrical Engineering and Computer Science for course 3681[8].
1 General Studies elective[6].

Materials Science Majors

Year 2
2.002A[3].
4.402, 4.522[9].
5.300, 5.4221
18.020
and either (Option 1):
2.002B, 2.131
4.512 *or* 4.802 (recommended)
10.022
or (Option 2):
10.111A (*or* 10.121A), 10.1113 (*or* 10.1213), 10.2111 (*or* 10.2211), 10.2112 (*or* 10.2212)
1 unit from[10]: 1.022, 1.982, 2.131, 4.512, 4.802, 10.1114 (*or* 10.1214)

Year 3
4.703
5.043, 5.122, 5.622
10.331
1 General Studies elective[6].
and either (Option 1):
4.433
48.403
or (Option 2):
3½ appropriate Level II or III units from Schools of Physics, Chemistry *or* Metallurgy offerings in Table 1* or Table 2* for course 3681[14].

For footnotes, see overleaf

Mathematics Majors

Year 2
Same Year 2 as for Computer Science or Materials Science (3 units of Level II mathematics option) or Physics or Statistics majors
or
1.002 *or* 1.012 *or* 1.022 *or* 1.032 *or* 2.002A[3].
5.300, 5.422
10.111A (*or* 10.121A), 10.1113 (*or* 10.1213), 10.1114 (*or* 10.1214), 10.2111 (*or* 10.2211), 10.2112 (*or* 10.2212)
3 units from 10.1115, 10.1116, 10.2113 (*or* 10.2213), 10.2115 (*or* 10.2215), 10.411A (*or* 10.421A), 10.411B (*or* 10.421B) *or* from any other appropriate Level II units from Table 1* *or* Table 2* for course 3681.
18.020

Year 3
5.043, 5.122, 5.622
10.331[12].
4 Level III units from School of Mathematics offerings in Table 1*
1 General Studies elective[6].

Physics Majors

Year 2
1.002, 1.012, 1.022, 1.032
5.300, 5.422
10.111A (*or* 10.121A), 10.1113 (*or* 10.1213), 10.1114 (*or* 10.1214), 10.2111 (*or* 10.2211), 10.2112 (*or* 10.2212)
18.020

Year 3
1.0133[11], 1.023, 1.0333[11], 1.043[11].
1 Level III unit from School of Physics offerings in Table 1*
5.043, 5.122, 5.622
10.331
1 General Studies elective[6].

Statistics Majors

Year 2
1.002 *or* 1.012 *or* 1.022 *or* 1.032, *or* 2.002A[3].
5.300, 5.422
10.111A (*or* 10.121A), 10.1113 (*or* 10.1213), 10.1114 (*or* 10.1214), 10.2111 (*or* 10.2211), 10.2112 (*or* 10.2212), 10.311A (*or* 10.321A), 10.311B (*or* 10.321B), 10.3111 (*or* 10.3211), 10.3112 (*or* 10.3212)
18.020

Year 3
5.043, 5.122, 5.622
4 Level III units from Statistics offerings in Table 1*
1 Level II or III unit from School of Mathematics or School of Physics offerings in Table 1*
1 General Studies elective[6].

Notes

1. Students who did not take 5.0201 Engineering Dynamics 1A in Year 1 must take it prior to taking 5.300.

2. The following considerations pertain to the choice of optional units in Years 2 and 3:

(1) They include no more than one Level 1 unit.

(2) They include at least four Level III units which satisfy the relevant major requirements.

(3) They include no more than one unit from schools other than Chemistry, Electrical Engineering and Computer Science, Mathematics, Metallurgy and Physics.

(4) They include at least one Level II unit from the Schools of Chemistry or Physics.

(5) They include 10.331 Statistics or 10.311B Basic Inference.

(6) 4.502 Mechanical Metallurgy and 4.512 Mechanical Properties of Solids are deemed to have reduced unit values of 1 and ½ respectively.

3. The prerequisite of 2.121 Chemistry 1A may be waived on application to the Head of the School of Chemistry.

4. Materials Science majors may omit 10.1114 Complex Analysis or substitute 10.022 Engineering Mathematics 2 for the mathematics subjects. The balance of the units must then be made up from units from the Schools of Chemistry, Metallurgy or Physics offerings in Table 1 or Table 2 for course 3681.

5. If 4.402 Physical Metallurgy 1 or 4.422 Metallurgical Phases 2 is taken, students should take 5.4221 instead of 5.422.

6. Anticipated. Actual General Studies requirements correspond to whatever is required in the second-year of the normal Mechanical and Industrial Engineering degree course.

7. Students intending to major in Computing Science and planning to take 6.647 Business Information Systems may substitute 14.501 Accounting and Financial Management 1A instead of 6.631 Computing 2B.

8. 6.646 Computer Applications is excluded for students in course 3661 who should substitute a Level III unit from Table 2 offerings of the School of Electrical Engineering and Computer Science.

9. Provided 5.4221 is taken concurrently with 4.522, the prerequisite requirement of 4.512 for 4.522 and the corequisite requirement of 4.502 for 4.402 are assumed to be satisfied.

10. Materials Science majors who took 2.121 Chemistry 1A in Year 1 must take 2.131 Chemistry 1B. Those who took 2.951 Chemistry 1ME and wish to keep open the option of majoring in mathematics should include 10.1114 (or 10.1214) Complex Analysis in their selection; otherwise they are advised to select 1.022 Modern Physics or 1.982 Solid State Physics.

11. Under special circumstances, with permission of the Head of the School of Physics, a student may substitute alternative Physics Level III offerings of equivalent unit value.

12. Students who followed the Year 2 for Computer Science majors should substitute 1.002 *or* 1.012 *or* 1.022 *or* 1.032 *or* 2.002A; those that followed the Year 2 for Statistics majors should substitute one Level II or III unit from the Schools of Physics or Mathematics offerings in Table 1.

13. Quota restrictions apply to certain Computer Science Level III units and application must be made in writing to the Head of the School of Electrical Engineering and Computer Science before the end of Session 2 in the preceding year. Prospective Computer Science Majors should aim for a creditable academic attainment (65%) over Years 1 and 2.

14. These must include either 4.403 Physical Metallurgy 2 or 4.433 Physical Metallurgy 2C. The latter is recommended together with either 2.003A Physical Chemistry or 1.023 Statistical Mechanics (for which the prerequisite of 1.012 is waived provided students have passed 2.002A).

15. The mathematics units are also offered at higher level.

*Tables refer to the Combined Sciences Handbook.

3610
Aeronautical Engineering

Bachelor of Engineering
BE

The first and second years of this course are identical with the first two years of the course in Mechanical Engineering. Subject to the Head of the School of Mechanical and Industrial Engineering being satisfied that the present extent of equivalences is maintained, and on his recommendation, Faculty has approved an arrangement by which students who satisfy the requirements of the first two years of the Mechanical Engineering full-time degree course at any other Australian tertiary institution may be admitted to a two-year program leading to the Bachelor of Engineering degree in Aeronautical Engineering.

Year 3		Hours per week S1	S2
5.034	Engineering Experimentation	1½	2
5.043	Industrial Training 1*	0	0
5.073	Numerical Analysis/ Mathematics†	3	3
5.303	Mechanical Vibrations	0	1½
5.343	Linear Systems Analysis‡	3	0
5.423	Mechanics of Solids 3	2	2
5.800	Aircraft Design 1	3	3
5.811	Aerodynamics 1	3	3
5.822	Analysis of Aerospace Structures 1	2	2
6.854	Electrical Engineering	0	3
6.856	Electronics for Measurement and Control	3	0
18.603	Management/Economics	2	2
	General Studies elective	2	2
		24½	23½

*Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to year 3.

†Combined degree course students who have taken 10.1114 Complex Analysis should substitute 18.803 Optimization for the Mathematics portion of this subject; if they have in addition taken 10.2113 Introduction to Linear Programming, they should substitute instead of 18.803 a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Faculty Handbook. Combined degree course students who have taken 10.211E Numerical Methods or 10.212A (or 10.222A) Numerical Analysis should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Combined Sciences Handbook for the Numerical Analysis portion of this subject.

‡Combined degree course students who have taken 10.212M (or 10.222M) Optimal Control Theory should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Combined Sciences Handbook.

Year 4		Hpw S1	S2
5.044	Industrial Training 2	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design 2	3	3
5.812	Aerodynamics 2	3	3
5.823	Analysis of Aerospace Structures 2	2	2
5.831	Aircraft Propulsion	2	2
	Technical Electives	3	3
	General Studies elective	2	2
		23	23

Note 1: The Technical Electives may be taken from the Mechanical Engineering or Industrial Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School (5.344 Feedback Control from Year 4 of the Mechanical Engineering degree course is recommended in this respect). Students with good academic records may include some graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.

Note 2: Only a limited number of Technical Electives is offered each year. The actual Technical Electives offered each year are decided on the basis of staff availability and student demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

3611
Aeronautical Engineering — Combined Course

Bachelor of Engineering/Bachelor of Science
BE BSc

The description of this course is identical with that for course 3681 BE BSc in Mechanical Engineering.

3700
Naval Architecture

Bachelor of Engineering
BE

The first and second years of this course are identical with the first two years of the Mechanical Engineering course. The Faculty of Engineering has approved an arrangement whereby, upon the recommendation of the Head of School, students who satisfy the requirements for the first two years of the Mechanical Engineering full-time degree course at any other Australian tertiary institution may be admitted to the final two years of the BE degree course in Naval Architecture.

For Years 3 and 4, see overleaf

Year 3

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	2
5.043	Industrial Training 1*	0	0
5.073	Numerical Analysis/ Mathematics†	3	3
5.303	Mechanical Vibrations	0	1½
5.423	Mechanics of Solids 3	2	2
5.901	Introduction to Mathematical Modelling and Decision Making	3	0
5.902	Ship Management Economics	0	2
5.911	Ship Hydrostatics	2½	2½
5.921	Ship Structures 1	2	2
5.9311	Principles of Ship Design 1	3	0
5.953	Ship Hydrodynamics	3	2
6.854	Electrical Engineering	0	3
6.856	Electronics for Measurement and Control	3	0
	General Studies elective	2	2
		25	22

*Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.

†Combined degree course students who have taken 10.1114 Complex Analysis should substitute 18.803 Optimization for the Mathematics portion of this subject; if they have in addition taken 10.2113 Introduction to Linear Programming, they should substitute instead of 18.803 a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Faculty handbook. Combined degree course students who have taken 10.211E Numerical Methods, or 10.212A (or 10.222A) Numerical Analysis, should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Combined Sciences Handbook for the Numerical Analysis portion of this subject.

Year 4

5.044	Industrial Training 2	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.922	Ship Structures 2	2	2
5.9321	Principles of Ship Design 2	4	2
5.937	Ship Design Project	3	4
5.941	Ship Propulsion and Systems	4	4
	General Studies elective	2	2
		23	22

3701
Naval Architecture — Combined Course

Bachelor of Engineering/Bachelor of Science
BE BSc

The description of this course is identical with that for course **3681** BE BSc in Mechanical Engineering.

Combined Courses
Bachelor of Engineering/Bachelor of Arts

3612
BE BA in Aeronautical Engineering

3662
BE BA in Industrial Engineering

3682
BE BA in Mechanical Engineering

3702
BE BA in Naval Architecture

Introduction

The Bachelor of Engineering and Bachelor of Arts combined degree course provides the opportunity of taking one of the normal accredited Engineering courses offered by the School of Mechanical and Industrial Engineering together with a normal Arts course. Common content between the two courses makes it possible to complete the combined degree course in 5 years, although the minimum time required could be longer, depending upon the choice of Arts subjects. The course is administered by the Faculty of Engineering.

The Engineering content follows that of the standard courses offered by the School of Mechanical and Industrial Engineering. It includes the Science/Arts compatible first year program which provides a wide range of course options at the end of Year 1. The options include, in addition to the BE BA combined program, a BE BSc combined program, a normal BE program, a normal BSc program and a normal BA program. (The Science/Arts compatible first year provides up to 30 Arts credit points towards a BA program.)

The Arts content is to be chosen from the Faculty of Arts offerings in the usual way and would depend upon the interests of each individual student. Refer to the Faculty of Arts handbook for further details.

Requirements

The broad requirements of the BE BA course are given below. The details of a particular student's program will depend upon the student's interests and the Arts content which is chosen. Sample programs are available on request to show typical arrangements.

Engineering

The program is to contain the Science/Arts compatible first year segment followed by the full program for one of the strands offered by the School of Mechanical and Industrial Engineering. Course variations may be permitted in some cases on application to the Head of School.

Arts
The Arts component of the program is to contain at least 60 Arts credit points in addition to Arts credit points allocated to components of the Engineering strand. (A session-length Arts subject normally carries 6 credit points.) The 60 must include
- no more than 30 First Level credit points (typically 5 one-session subjects)
- at least 24 Upper Level credit points forming a major sequence (typically 4 one-session subjects)
- at least 6 Upper Level credit points in a school other than that in which the major is taken.

Computing and mathematics majors are not permitted. The combined BE BSc program would be more appropriate in these cases.

Honours
In the Engineering component, Honours are awarded for superior performance in the standard program.

In the Arts component, the award of Honours requires at least one further year of study devoted exclusively to the Honours subject(s). Consult the Faculty of Arts for further details.

General
A BE BA proposal should be discussed with representatives of the School of Mechanical and Industrial Engineering and the Faculty of Arts as early as possible. In many cases this will be at (or preferably before) first year enrolment, but a student who has satisfactorily completed the Science/Arts compatible first year will normally be able to transfer to the second year of a combined BE BA program, and the discussions could then take place at any time before second year enrolment. Enquiries should be directed to the Executive Assistant to the Head of the School of Mechanical and Industrial Engineering and the Executive Assistant to the Dean of the Faculty of Arts.

Department of Industrial Engineering

The Department of Industrial Engineering offers a course in Industrial Engineering leading to the award of the degree of Bachelor of Engineering. This course is designed for students with engineering ability whose interests lie in the planning, developing and control of manufacturing or service operations. It may be taken either on a full-time basis, normally over four years or on a part-time basis, or on a combined full-time/part-time basis subject to the approval of the Head of the School of Mechanical and Industrial Engineering. Students intending to enter part-time study are advised that many subjects in the later years of the course are offered only in the day-time. Part-time students normally take two years for each equivalent full-time year and are required to attend day classes for the equivalent of at least one day per week.

The first two years of the degree course, taken full-time, provide the student with a sound foundation in the basic science and engineering subjects, and this knowledge is used and extended in the later years in the study of the industrial subjects in which the problems associated with the practical economics of manufacturing operations are stressed. The aim is to provide the student with the education necessary to carry out an industrial job and to examine it critically in the light of economic efficiency.

Traditional engineering courses do not embrace the problems which are characteristic of Industrial Engineering. These problems include the analysis of a product to ensure satisfactory functioning with regard to methods and sequence of manufacturing operations; the disposition of buildings and of equipment within them to permit efficient handling of materials; the avoidance of bottlenecks; the related problems of quality and cost control, testing and inspection; labour and personnel relations; and, finally, the problem of distribution and sales.

The financial and economic aspects are studied as the problem in manufacturing has not been solved until the final translation of the product into money has been accomplished successfully. While it is not intended to develop an expert in accounting practice or economics, it is intended to produce an engineer with an appreciation of the problems of cost and one who can apply considerations of ultimate economy to all industrial problems. The techniques of operations research may be applied here, where mathematical models of real life situations are constructed and manipulated to yield optimal solutions as guides to management.

The Work of the Industrial Engineer

The industrial engineer may initially be employed in any of the following major areas of industrial activity:

1. Industrial Economic Analysis

One of the principal functions of industrial engineering is to analyse a product, project or process from the economic point of view to ensure that an adequate profit can be obtained. A general working knowledge of economics and management skill has to be directed towards the making of decisions on how to operate an enterprise most efficiently. The basis for such decisions is furnished largely by the logical application of mathematics and statistics.

2. Planning and Control of Production

Manufacturing processes and operations must be planned in detail throughout an enterprise to ensure that they proceed smoothly and economically. Functions in this field include the establishment of production standards, the setting of production targets and, the control of quality.

The ultimate responsibility of those in charge of the planning and control of production is to ensure that the goods, as originally specified, perform satisfactorily and are produced when required at an optimum cost. Computer systems are increasingly being used to achieve this.

3. Product and Process Design

The design interest of the industrial engineer goes beyond normal mechanical design to develop a product that will not only function effectively but also have a pleasing appearance.

Further, the product has to be adapted to suit existing manufacturing equipment, or a manufacturing process has to be developed by means of which an existing product can be manufactured at the right price and of the right quality. The design work of the industrial engineer also incorporates problems of process selection and application for both economy and performance. Fundamental scientific studies of manufacturing processes such as metal machining, forming and casting are continually being made to improve their efficiency.

The introduction of computers has led to the automation of some aspects of product and process design. For example, developments in CAD-CAM (Computer Aided Design and Computer Aided Manufacturing) have resulted in improvements in the competitiveness of companies in the marketplace and these techniques are becoming increasingly important.

The principles for minimizing product cost can also be effectively applied to the provision of services.

4. Methods Engineering

Methods engineering is concerned with the design of systems to properly utilize and co-ordinate personnel, materials and machines so that an enterprise will run efficiently. A sound knowledge of engineering in general, together with an understanding of human factors and economics is necessary for this work. It includes the design of plant layouts and materials handling systems, job design and the setting of standard times for work.

5. Operations Research

This is the attack of modern science on complex problems arising in the direction and management of large systems of people, machines, materials and money in industry, business, government and defence. The distinctive approach is to develop a scientific model of the system, incorporating measurements of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically.

Employment in any of these fields may well lead to a position of responsibility in industrial management if the engineer is so inclined.

3660
Industrial Engineering
Bachelor of Engineering
BE

The first and second years of this course are identical with the first two years of the course in Mechanical Engineering.

Year 3

		Hours per week S1	S2
5.043	Industrial Training 1†	0	0
6.854	Electrical Engineering	0	3
6.856	Electronics for Measurement and Control	3	0
14.001	Introduction to Accounting A	1½	0
14.002	Introduction to Accounting B	0	1½
18.003	Numerical Methods/Industrial Experimentation	1½	2
18.303	Methods Engineering	2	2
18.403	Production Design and Technology	4	4
18.413	Design for Industrial Engineers	2	3
18.503	Operations Research A	3	3
18.603	Management/Economics	2	2
18.803	Optimization	3	0
	General Studies elective	2	2
		24	22½

†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.

Year 4

5.044	Industrial Training 2	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
18.004	Manufacturing Management	2	2
	Technical Electives	10	10
	General Studies elective	2	2
		22	22

Note 1: At least 6 hours per week of Technical Electives must be taken from the Industrial Engineering Technical Elective List. The remaining Technical Electives may be taken from the Mechanical Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School. Students with good academic records may include some graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.

Note 2: Only a limited number of Technical Electives is offered each year. The actual Technical Electives offered each year are decided on the basis of staff availability and student demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

Industrial Engineering Technical Electives

Production Engineering		Hours per week S1		S2
5.454	Theory of Plasticity	3	*or*	3
18.224	Numerical Control of Machine Tools	3	*or*	3
18.404	Design for Production	2		2
18.360G	Ergonomics	0		3
18.371G	Factory Design and Layout	3		0

		Hpw S1		S2
Operations Research				
5.074	Computing Science for Mechanical Engineers	3		0
18.574G	Management Simulation	1		2
18.671G	Decision Theory	2	*or*	2
18.673G	Energy Modelling, Optimization and Energy Accounting	3	*or*	3
18.764G	Management of Distribution Systems	2	*or*	2
18.765G	Optimization of Networks	2	*or*	2
18.777G	Time Series and Forecasting	2	*or*	2
18.864G	Applied Geometric Programming	2	*or*	2
18.874G	Dynamic Programming	2	*or*	2
18.878G	Industrial Applications of Mathematical Programming	2	*or*	2

Note: The graduate subjects listed should be of particular interest to undergraduate students; with approval, other graduate subjects from this and other Schools may be taken.

3661
Industrial Engineering — Combined Course
Bachelor of Engineering/Bachelor of Science
BE BSc

The description of this course is identical with that for course 3681 in Mechanical Engineering.

3662
Industrial Engineering — Combined Course
Bachelor of Engineering/Bachelor of Arts
BE BA

See description under *Combined Courses Bachelor of Engineering/Bachelor of Arts*, immediately preceding the heading *Department of Industrial Engineering*.

School of Surveying

Head of School
Associate Professor G. G. Bennett

Administrative Assistant
Vacant

The School of Surveying offers a full-time course of four years' duration leading to the award of the degree of Bachelor of Surveying. Alternatively, the course may be taken in a sandwich form in which a student may, after completing the first year of the course on a full-time basis, alternate his or her studies with periods of employment by taking leaves of absence of up to two consecutive sessions at a time thereafter. The course taken in this form requires a maximum period of seven years. The part-time course is no longer available.

The Bachelor of Surveying is a well-rounded course with a strong surveying base, aimed at preparing the graduate for a broad range of career opportunities, including land boundary surveying, engineering surveying, photogrammetry, cartography, mining surveying, hydrographic surveying, geodesy and geodetic surveying, computing and systems development, management and development of land, land information systems, resource assessment systems and remote sensing. The course recognizes the diversity of possible roles of a graduate who may be called on during his or her career to act as practitioner, consultant, manager, teacher or researcher.
The course has undergone comprehensive revision. Features of the revision include

- increased time for surveying subjects to strengthen the theoretical and practical framework and to include within the course core subject material which was previously in the electives Mine Surveying, Hydrographic Surveying and Precise Engineering Surveying.
- a major re-arrangement of Geodesy, Astronomy and Map Projections to bring the material into an order related to function. For example methods of positioning by terrestrial astronomy and satellite positioning are taught in a related manner.
- re-arrangement of the computing and programming subjects to form a carefully designed progression; and the addition of a new subject Computer Graphics within this strand.
- the expansion of the photogrammetry core subjects by including within the course core most of the material offered at present in the elective subject Photogrammetry 3.
- the reduction in the number of technical electives in Year 4 of the course.
- further development of the land studies area to include resource surveys and remote sensing. Almost double the time has been allocated for cadastral surveying and land law, and
- arising from the new definition of general studies, the inclusion of the so-called contextual or professionally related subjects within the course.

Throughout the course theoretical studies are complemented by practical exercises in the field and the laboratory. Students make use of the most modern measuring instruments and computing equipment.

The School also offers a full-time course of four years' duration leading to the award of the degree of Bachelor of Surveying Science. The course is designed to give an interested student the opportunity to obtain greater depth as an undergraduate in one or more of the disciplines associated with surveying: land development, cartographic science, geodesy and geophysics, environmental studies, remote sensing and photogrammetry. It is so structured that:

1. All students must take a core consisting of 104 contact hours made up from some of the subjects of the Bachelor of Surveying course. These core subjects include the formal strands in Mathematics, Physics, Physical Geography, Surveying, written and spoken communication, and 12 hours of General Studies.

2. The balance, totalling 76 hours, must comprise:
a) at least 9 hours taken from elective subjects of the final year of the Bachelor of Surveying course;
b) the remainder made up from any subjects required as prerequisites for a) above *and* any combination of subjects offered by the University and approved by the Head of School for the individual program of study. Such approval would require that the student follow a particular sequence of subjects within a given subject area. Subjects offered by the University of Sydney and Macquarie University may also be taken subject to approval by the Head of School.

3. Resolution of class scheduling problems is the responsibility of the student.

Bachelor of Surveying students in their later years of study may elect to transfer to this course if they so desire.

The Bachelor of Surveying or the Bachelor of Surveying Science degree may be awarded as a Pass degree, Honours Class I, or Honours Class II in two divisions. Honours are awarded in recognition of superior performance throughout the course.

Students wishing to become Registered Surveyors after graduation are advised to gain practical experience under a Registered Surveyor. Some reduction in the period of practical experience required before registration may be granted because of practical experience gained during the University course, provided the New South Wales Surveyors' Board is informed in the prescribed manner. Details are obtainable from the Registrar, Surveyors' Board, Department of Lands, Bridge Street, Sydney 2000. The degree of Bachelor of Surveying confers exemption from all written examinations of the Surveyors' Board. In the case of the Bachelor of Surveying Science degree, the New South Wales Surveyors' Board may require additional subjects for registration.

Students enrolled in either course are required to equip themselves with an electronic calculator. Advice on the purchase of this equipment is given to students at the commencement of their course.

3740
Surveying
Bachelor of Surveying
BSurv

Year 1

		Hours per week
Session 1		
1.971	Physics I	6
8.0102	Introduction to Engineering Design	2
10.001	Mathematics I	6
29.1010	Surveying I	5
29.1110	Computations 1	2
29.1710	Professional Orientation*	1½
	General Studies Elective	2
		24½

*Three half-day excursions are an essential part of this subject.

Session 2		
1.971	Physics I	6
5.0302	Engineering Drawing and Descriptive Geometry	4
10.001	Mathematics 1	6
29.2010	Surveying 2	4
29.2040	Survey Drafting	3
29.2050	Survey Camp†	3
	General Studies Elective	2
		28

†Students are required to attend a one-week survey camp equivalent to 3 class contact hours per week.

Year 2

Session 1		
1.962	Physics of Measurement	3
10.022	Engineering Mathematics 2	4
10.341	Statistics SU	2
27.295	Physical Geography for Surveyors†	4
29.3010	Surveying 3	4½
29.3110	Survey Computations 1	4½
		22

†One-day field tutorial is an essential part of this course.

Session 2		
10.022	Mathematics 2	4
10.341	Statistics	2
29.4010	Surveying 4	5
29.4150	Electronics for Surveyors	2
29.4220	Introduction to Geodetic Science	3
29.4520	Remote Sensing and Resource Surveys	3
29.4710	Report Writing	2
29.4810	Land Management and Development 1	3
29.4050	Survey Camp*	3
		27

*Students are required to attend a one-week survey camp, which is equivalent to 3 class contact hours per week.

Year 3

Session 1

		Hpw
8.6140	Engineering for Surveyors 1	3
29.5010	Surveying 5	4½
29.5110	Survey Computations 3	4
29.5220	Geodetic Positioning	2½
29.5230	Map Projections	2½
29.5610	Cadastral Surveying and Land Law 1	3½
36.411	Town Planning	2
		22

Session 2

8.6150	Engineering for Surveyors 2	3
29.6010	Surveying 6	4½
29.6220	Field Astronomy	3
29.6510	Photogrammetry 1	3
29.6610	Cadastral Surveying and Land law 2	6
29.6810	Land Management and Development 2	3
		22½

Year 4

Session 1††

29.212	Geodesy 2	3
29.312	Astronomy 2	2
29.512	Photogrammetry 2	3
29.653	Land Development 3†	3
29.704	Management 1	2
29.702	Seminar 2	1
	Electives*	6
29.196	Survey Camp 4**	6
		26

†One-day field tutorial is an essential part of this subject.
*See Year 4: Electives, below.
**Two weeks of office computations equivalent to 6 class contact hours per week.

Session 2††

29.705	Management 2	2
29.703	Seminar 3	1
	Electives*	15
		18

*See Year 4: Electives, below.
††Offered in 1985 only.

Year 4 Electives

Electives include both General Studies and Technical Electives. Students re-enrolling in 1985 are required to take no more than 168 hours of General Studies electives in the entire course to fulfil requirements for the BSurv degree. A General Studies elective taken in or after 1983 is equal to 56 hours and a half elective to 28 hours. Every student is required to take five Technical Electives. Technical Electives (of three hours per week each, except 29.174) are chosen from:

29.031	Electronic Distance Measurement
29.032	Precise Surveying in Industry and Engineering
29.033	Characteristics of Modern Theodolites and Levels
29.034	Mine Surveying*
29.035	History of Surveying
29.153	Adjustment of Control Surveys
29.161	Hydrographic Surveying 1
29.162	Hydrographic Surveying 2
28.173	Project
29.174	Major Project (6 hours per week)
29.213	Geodesy 3
29.231	Geophysics for Surveyors
29.232	Atmospheric Effects on Geodetic Measurement
29.313	Astronomy 3
29.513	Photogrammetry 3
29.514	Remote Sensing Principles'
27.1712	Remote Sensing Applications
29.654	Land Development 4
29.632	Land Inventory 2
29.663	Cadastral Surveying and Land Law 3
29.664	Modern Title Concepts
29.802	Cartography 2
29.803	Mapping Technology

Not all electives are offered in any one year. Subjects from other Schools and Faculties may be substituted with the approval of the Head of School.

*A one-day practical exercise is a compulsory part of this course.

Year 4

*Session 1**

		Hpw
29.7010	Surveying 7	4½
29.7120	Computer Graphics	2
29.7220	Geodetic Computations	3
29.7510	Photogrammetry 2	4
29.7810	Land Management and Development 3**	2
29.7050	Survey Camp†	9
	Technical Elective††	3
	General Studies Elective	4
		31½

*Session 2**

29.8010	Surveying 8	5
29.8220	Global Geodesy	2½
29.8510	Photogrammetry 3	3
29.8710	Seminar	1½
29.8720	Management	2
29.8810	Land Management and Development 4	2
	Technical Elective††	3
	General Studies Elective	1
		23

*Offered from 1986.
**One day field tutorial is an essential part of this subject.
†Students are required to attend a three week survey camp equivalent to 9 contact hours per week.
††Technical electives (each of 3 hours per week) are chosen from those listed overleaf.

Technical Electives

29.9010	Advanced Surveying Instruments
29.9020	Hydrographic Surveying
29.9030	Precise Engineering Surveying
29.9210	Adjustment of Control Networks
29.9220	Advanced Geodetic Positioning
29.9520	Remote Sensing
29.9530	Land Information Systems
29.9610	Modern Cadastral Concepts
29.9090	Project
29.9910	Special Topic A
29.9920	Special Topic B

Not all electives are offered in any one year. Subjects from other Schools and Faculties may be substituted with the approval of the Head of School.

3760
Surveying Science

Bachelor of Surveying Science
BSurvSc

The course consists of a mandatory program of 104 class contact hours including a General Studies program of 12 hours and an Elective Program of at least 76 hours. A student may undertake in any one session a load generally not exceeding 24 hours, comprising subjects from one or more of these programs, provided they are taken in sequence within each subject area and in accordance with their pre-requisite and/or co-requisite requirements.

Mandatory Program

The mandatory program consists of the following subjects:

		Hours per week	
1.971	Physics 1	12	*
10.001	Mathematics 1	12	*
29.1010	Surveying 1	5	*
29.2010	Surveying 2	4	*
29.2050	Survey Camp 1	3	*
29.1710	Professional Orientation	1½	*
1.962	Physics of Measurement**	3	†
10.022	Engineering Mathematics 2**	8	†
10.341	Statistics SU**	4	†
27.295	Physical Geography for Surveyors**	4	†
29.3010	Surveying 3	4½	†
29.4150	Electronics for Surveyors**	2	†
29.3110	Survey Computations 2	4½	†
29.4710	Report Writing	2	†
29.4220	Introduction to Geodetic Science	3	†

		Hpw	
29.5110	Survey Computations 3	4	§
29.5220	Geodetic Positioning	2½	§
29.5230	Map Projections	2½	§
29.6510	Photogrammetry 1	3	§
29.8710	Seminar	1½	§
6.611	Computing 1	6	§
		92	

*Offered in Year 1 of the BSurv Course (3740).
†Offered in Year 2 of the BSurv Course (3740).
‡Offered in Year 3 of the BSurv Course (3740).
§Offered in Year 4 of the BSurv Course (3740).
**May be replaced by a similar subject at least equal in coverage of the topic. Any resulting additional contact hours may be used in satisfying the Elective Program.

General Studies Program

This program consists normally of 3 General Studies subjects of 4 hours each per week over a single session (or their equivalent) and may be undertaken at any time during Years 2-4 of the Course, subject to the total load for a session, which, as a rule, should not exceed 24 hours.

Elective Program

This program consists of at least 18 hours (or 6 technical electives) selected from elective subjects of the final year of the BSurv course plus any subjects required as prerequisites for these electives *and* any combination of subjects offered by this University, the University of Sydney or Macquarie University provided that they are approved by the Head of School for the individual program of study. Such approval would require that a student follows a particular sequence of subjects within a selected area. This prescription means in effect that the elective component of the course can be varied to enable the student to choose the specialization that best suits his or her individual requirements so long as such specialization falls within the general disciplines associated with Surveying. Electives for such specialization may be chosen, for instance, from subject areas such as:

Cartography and Mapping Technology
Geography, Geographic Data Analysis, Mathematical Methods for Spatial Analysis
Town, Urban and Neighbourhood Planning
Geodesy, Geology, Earth Physics, Oceanography and Marine Science
Astronomy
Photogrammetry, Remote Sensing
Land Law, Title Concepts, Cadastral Surveying
Land Inventory
Land Development and Management
Building Economics
Accounting and Computer Applications

Illustrative examples of programs that could be taken are available from the School.

Undergraduate Study:

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.

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.

The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being the General Studies subjects. For General Studies subjects see the **General Studies 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.

Information Key

The following is the key to the information which may be supplied about each subject:

- S1 (Session 1); S2 (Session 2)
- F (Session 1 *plus* Session 2, ie full year)
- S1 or S2 (Session 1 *or* Session 2, ie choice of either session)
- SS (single session, but which session taught is not known at time of publication)
- CCH class contact hours
- L (Lecture, followed by hours per week)
- T (Laboratory/Tutorial, followed by hours per week)
- hpw (hours per week)
- C (Credit *or* Credit units)
- CR (Credit Level)
- DN (Distinction)

	School, Department etc	Faculty	Page
	*Undergraduate subjects also offered for courses in this handbook		
1	School of Physics*	Science	67
2	School of Chemistry*	Science	69
4	School of Metallurgy*	Applied Science	71
5	**School of Mechanical and Industrial Engineering**	Engineering	71
6	**School of Electrical Engineering and Computer Science**	Engineering	79
7	School of Mining Engineering	Applied Science	
8	**School of Civil Engineering**	Engineering	85
9	School of Wool and Pastoral Sciences	Applied Science	
10	School of Mathematics*	Science	91
11	School of Architecture	Architecture	
12	School of Psychology	Biological Sciences	
13	School of Textile Technology	Applied Science	
14	School of Accountancy*	Commerce	95
15	School of Economics*	Commerce	95
16	School of Health Administration*	Professional Studies	95
17	Biological Sciences	Biological Sciences	
18	**School of Mechanical and Industrial Engineering (Industrial Engineering)**	Engineering	96
21	Department of Industrial Arts	Architecture	
23	**School of Nuclear Engineering**	Engineering	97
25	School of Applied Geology*	Applied Science	97
26	Department of General Studies	Board of Studies in General Education	
27	School of Geography*	Applied Science	99
28	School of Marketing	Commerce	
29	**School of Surveying**	Engineering	101
30	Organizational Behaviour*	Commerce	107
31	School of Optometry	Science	
32	**Centre for Biomedical Engineering**	Engineering	
35	School of Building	Architecture	
36	School of Town Planning*	Architecture	107
37	School of Landscape Architecture	Architecture	
38	School of Food Technology	Applied Science	
39	Graduate School of the Built Environment	Architecture	
40	Professorial Board		
41	School of Biochemistry	Biological Sciences	
42	School of Biotechnology	Biological Sciences	
43	School of Botany	Biological Sciences	

	School, Department etc	Faculty	Page
	*Undergraduate subjects also offered for courses in this handbook		
44	School of Microbiology	Biological Sciences	
45	School of Zoology	Biological Sciences	
46	Faculty of Applied Science	Applied Science	
47	**Faculty of Engineering**	**Engineering**	
48	School of Chemical Engineering and Industrial Chemistry*	Applied Science	108
50	School of English	Arts	
51	School of History	Arts	
52	School of Philosophy	Arts	
53	School of Sociology	Arts	
54	School of Political Science	Arts	
55	School of Librarianship	Professional Studies	
56	School of French	Arts	
57	School of Drama	Arts	
58	School of Education	Professional Studies	
59	Department of Russian	Arts	
60	Faculty of Arts	Arts	
61	Department of Music	Arts	
62	School of History and Philosophy of Science	Arts	
63	School of Social Work	Professional Studies	
64	School of German Studies	Arts	
65	School of Spanish and Latin American Studies	Arts	
66	Subjects Available from Other Universities		
67	Faculty of Science	Science	
68	Board of Studies in Science and Mathematics	Board of Studies in Science and Mathematics	
70	School of Anatomy*	Medicine	108
71	School of Medicine	Medicine	
72	School of Pathology	Medicine	
73	School of Physiology and Pharmacology	Medicine	
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
77	School of Psychiatry	Medicine	
78	School of Medical Education	Medicine	
79	School of Community Medicine	Medicine	
80	Faculty of Medicine	Medicine	
81	Medicine/Science/Biological Sciences	Medicine	
85	Australian Graduate School of Management	AGSM	
90	Faculty of Law*	Law	108
97	Division of Postgraduate Extension Studies		

Physics

The School of Physics has introduced the specialized units 1.951, 1.961, 1.971, 1.981, 1.962, 1.972 and 1.982 for students in the Faculty of Engineering. The first-year units 1.951, 1.961, 1.971 and 1.981 are *not* available at night. Part-time students will be catered for by the Science Course unit 1.001.

All first year full-time students, including repeat students, should enrol in 1.951, 1.961, 1.971, 1.981 according to their schools.

All first year part-time students, including repeats, should enrol in 1.001.

Physics Level I Units

1.001 Physics 1 — F L3T3

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100 or*
and	*(for 1.001 only) 10.021B*
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31.100*
4 unit Science (Multistrand)	*31.100*

Co-requisite: 10.021C or 10.001 or 10.011.

*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, inertial mass, energy, momentum, charge, potential, fields. Application of the conservation principles to solution of problems involving charge, energy and momentum. Electrical circuit theory, application of Kirchoff'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.

1.951 Physics 1 (Mechanical Engineering) — F L2T2

Prerequisites: As for 1.001 Physics 1.

For students in the School of Mechanical and Industrial Engineering.

Physical properties of solids, liquids and gases: microscopic theory of elasticity, friction, fracture in solids, viscosity in liquids and kinetic theory of gases. Dynamics of solids and fluids: Newton's laws, energy and momentum conservation, rotational mechanics, fluid mechanics. Compressional waves: acoustics. Thermostatic properties of matter: concepts of thermodynamics, thermal properties of liquids and solids. Electric fields and currents: electrostatics, direct-current circuits. Electromagnetism: magnetic forces and fields, electro-magnetic induction. Non-steady electric currents, transients in RC, LR and LC circuits, alternating-current circuits. Optics: geometric optics, optical instruments, interference and diffraction, polarization.

1.961 Physics 1 (Electrical Engineering) — F L3T3

Prerequisite: As for 1.001 Physics 1.

For students in the School of Electrical Engineering.

Electrostatics in vacuum, electrostatics in dielectrics, steady state currents, magnetostatics in vacuum, ferromagnetism, electromagnetic induction, transient currents. Vectors, motion in one dimension, motion in a plane, particle dynamics, work and energy, the conservation of energy, conservation of linear momentum, collisions, rotational kinematics, rotational dynamics, simple harmonic motion, gravitation. Temperature, heat and the first law of thermodynamics, kinetic theory of gases. Waves in elastic media, sound waves, geometrical optics, interference, diffraction, gratings and spectra, polarization.

1.971 Physics 1 (Surveying) — F L3T3

Prerequisite: As for 1.001 Physics 1.

For students in the School of Surveying.

Aims and nature of physics, linear and rotational mechanics, hydrostatics, elasticity, gravitation, temperature, electricity and magnetism, wave motion, optical instruments, interference and diffraction, lasers and atomic clocks. The importance in surveying of precise frequency, time, speed and distance measurements.

1.981 Physics 1 (Civil Engineering) — S1 L2T2 and S2 L2T1

Prerequisite: As for 1.001 Physics 1.

For students in the School of Civil Engineering.

Aims of physics and its relation to civil engineering. Mechanical concepts, properties of matter, atomic structure, elasticity, plasticity, fracture of solids; surface tension and viscosity of fluids, electrical and magnetic forces, electromagnetism, DC and AC circuits, digital electronics. Simple harmonic motion and its relation to wave motion. Acoustic and mechanical waves, attenuation, velocity of propagation. Elastic moduli. Non-destructive testing, instrumentation, techniques and theory. Emphasis on the physics involved in non-destructive testing and the aspects of vibration important to civil engineering.

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.

Harmonic motion, systems of particles, central force problems, Lagrange's equations, coupled oscillations, travelling waves, pulses, energy and momentum transfer, polarization, birefringence, interference, thin films, gratings, lasers, holography, fibre optics, Faraday effect, photoelasticity.

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.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarization, magnetism, electro-magnetic induction, Maxwell's equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwell's relations, phase diagrams, chemical and electrochemical potential.

1.022 Modern Physics F L1½T½

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 F T3

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 S1 L2T3

Prerequisites: 1.061 or 1.041. 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.

1.962 Physics of Measurement (Surveying) S1 L1T2

Prerequisite: 1.971.

For students in the School of Surveying.

Resolution, accuracy and sensitivity of instruments. Errors of observation and their treatment. Experimental design. Displacement transducers. Transducers for other mechanical quantities. Thermometry. Electrical noise. Dynamic response of measuring systems. Servosystems. Mechanical design of apparatus. Microscopes, telescopes and other optical instruments. Lenses, optical fibres and other optical components. Photometry. Colorimetry. Measurements under adverse ambient conditions. Analogue-to-digital conversion. Digital instruments. Measurements of very large and very small quantities.

1.972 Electromagnetism (Electrical Engineering) S1 or S2 L2T2

Prerequisite: 1.961 or 1.001 or 1.011, 10.001. Co-requisites: 10.2111, 10.2112. Excluded: 1.012.

Electrostatics in vacuum, Electrostatics in Dielectrics, electric currents, magnetostatics in vacuum, magnetic scalar potential, magnetostatics in magnetic media, time varying fields, Maxwell's equations.

1.982 Solid State Physics (Electrical Engineering) S1 or S2 L2½T2

Prerequisite: 1.961 or 1.001 or 1.011, 10.001. Co-requisites: 10.2111, 10.2112. Excluded: 1.022, 1.9322.

The concepts of waves and particles, introductory quantum mechanics, atomic structure, optical spectra and atomic structure, structural properties of solids, band theory and its applications, uniform electronic semiconductors in equilibrium, excess carriers in semiconductors.

1.992 Mechanics and Thermal Physics (Electrical Engineering) F L1½T½

Prerequisite: 1.961, 10.001 or 10.011. Co-requisites: 10.2111. Excluded: 1.002, 1.012.

Particle mechanics, harmonic motion, central force problems, systems of particles, Lagrange's equations with applications, coupled oscillations, wave equation. Thermodynamic laws, entropy, kinetic theory, M-B distribution, microscopic processes, Maxwell's relations, chemical potential, phase diagrams, multicomponent systems, electrochemical potential, statistics of defects in solids.

Physics Terminating Level II Units

1.9222 Electronics S1 L1T2

Prerequisites: 1.001 or 1.001 or 1.021. Excluded: 1.032.

The application of electronics to other disciplines. Includes: principles of circuit theory and analogue computing; amplifers, their specification and application, transducers; electronic instrumentation; industrial data acquisition.

1.9322 Introduction to Solids S2 L2T1

Prerequisites: 1.001 or 1.011 or 1.021. Excluded: 1.022, 4.402, 4.412.

Introductory quantum mechanics and atomic physics; crystal structure; point and line defects; introductory band theory; conductors, semi-conductor and insulators; energy level diagrams.

Physics Level III Units

1.0133 Quantum Mechanics S1 L1½T½

Prerequisites: 1.022, 10.2112. Excluded: 2.023A, 10.222F, 1.013.

Revision of basic concepts, harmonic oscillator systems, spherically symmetric systems, angular momentum, H atom, first-order perturbation theory, identical particles, Exclusion Principle, atomic structure, spin-orbit coupling, Helium atom, introductory quantum theory of molecules.

1.023 Statistical Mechanics and Solid State Physics — S1 L3T1

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.

1.0333 Electromagnetism — S1 L1½T½

Prerequisites: 1.012, 10.2111, 10.2112. Excluded: 10.222C, 1.033.

Electromagnetic fields; Maxwell's equations, Poynting theorem, electromagnetic potentials, electromagnetic waves. Reflection and transmission, Fresnel equations, waveguides, radiation fields, dipoles and antenna theory.

1.043 Experimental Physics A — F T4

Prerequisite: 1.032.

Basic experimental techniques and analysis of results in the following areas: electricity, magnetism, diffraction optics (including X-ray and electron diffraction, solid state physics, nuclear physics, atomic physics and spectroscopy, vacuum systems).

Chemistry

Level I Units

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 prerequisite 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 Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science (multistrand) or	*31-100*
2 unit Science (Geology) or	*51-100*
2 unit Science (Biology)	*51-100*
or	
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).

Stoichiometry and solution stoichiometry. Properties of gases; kinetic molecular theory. Thermochemistry. Atomic structure, electron configurations and the periodic table. Types of chemical bonds, electronegativity, molecular geometry. Periodicity of physical and chemical properties of common representative elements and compounds. Liquids and solids, changes of state, phase diagrams. Types of solids. Solutions and their properties. Colloids. Facts and theories about reaction kinetics.

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 prerequisite 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.

2.131 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, stereoisomerism; 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.

2.951 Chemistry 1ME — S2 L3T3

Prerequisite: Nil.

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.

2.991 Chemistry 1CE — S2 L3T3

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science (multistrand) or	*31-100*
2 unit Science (Geology) or	*51-100*
2 unit Science (Biology)	*51-100*
or	
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).

Atomic and molecular structure and bonding. Chemical equilibrium. Rates of reactions. Thermochemistry. Ionic equilibria. Metals, electrochemistry and corrosion. Colloids and clays. Colligative properties of solutions. Organic chemistry, polymers. Applications of chemical principles to engineering.

Level II Units

2.002A Physical Chemistry — S1 or S2 L3T3

Prerequisites: 2.121 & 2.131, or 2.141; and 10.011 or 10.001 or 10.021B & 10.021C.

Thermodynamics: first, second and third laws of thermodynamics; statistical mechanical treatment of thermodynamic properties; applications of thermodynamics: chemical equilibria, phase equilibria, solutions of nonelectrolytes and electrolytes, electrochemical cells. Kinetics: order and molecularity; effect of temperature on reaction rates; elementary reaction rate theory. Surface chemistry and colloids: adsorption, properties of dispersions; macromolecules and association colloids.

2.002B Organic Chemistry — F or S2 L3T3

Prerequisite: 2.131 or 2.141.

Chemistry of the more important functional groups; aliphatic hydrocarbons, monocyclic aromatic hydrocarbons, halides, alcohols, phenols, aldehydes, ketones, ethers, carboxylic acids and their derivatives, nitro compounds, amines and sulphonic acids.

2.002D Analytical Chemistry — SS L2T4

Prerequisites: 2.121 & 2.131, or 2.141; and 10.001 or 10.011 or 10.021B & 10.021C.

Chemical equilibria in analytical chemistry. Acid-base, complex formation, redox systems, solid/solution, and liquid/liquid equilibria with applications to volumetric, gravimetric and complexometric analysis, and to liquid/liquid extractions. Spectrophotometry, basic principles. Chromophores. Fundamentals of precision. Electrochemistry, theory and applications to electrodeposition and potentiometry; ion selective electrodes. radioactive tracer techniques. Data evaluation in analytical chemistry. Qualitative analysis.

2.042C Inorganic Chemistry — SS L2T4

Prerequisites: 2.121 & 2.131, or 2.141.

Chemistry of the non-metals including B, C, Si, N, P and S. Chemistry of the metals of groups 1A, 2A, and Al. Typical ionic, giant-molecule and close-packed structures. Transition metal chemistry, including variable oxidation states, paramagnetism, Werner's theory, isomerism of six and four-coordinate complexes, chelation, stabilization of valency states. Physical methods of molecular structure determination. Chemistry of Fe, Co, Ni, Cu, Ag, Au and Hg.

Level III Units

2.003A Physical Chemistry — SS L3T3

Prerequisite: 2.002A.

Thermodynamics, including non-ideal systems; advanced electrochemistry; statistical thermodynamics; applications to gases, liquids and chemical equilibria; states of matter.

2.003C Inorganic Chemistry — S1 or S2 L2T4

Prerequisite: 2.042C.

Coordination chemistry: valence bond and crystal field theory and their application to magnetic and spectral properties of complexes. Factors affecting the stability of complexes; unusual oxidation states of transition metals. Chemistry of the groups 3A (the lanthanides and actinides), IVA, VA, VIA and VIIA. More advanced chemistry of groups 3B, IVB, VB, VIB and VIIB and the noble gases.

2.013C Advanced Inorganic Chemistry — SS L2T4

Prerequisite: 2.042C. Co-requisite: 2.003C.

Reaction mechanisms involving metal complexes. Spectroscopic methods for investigating metal complexes, including infrared, electronic and Mössbauer spectroscopy. Inorganic crystal chemistry: structures and properties of simple compounds. Cluster compounds, metal-metal bonding, extended electronic interactions. π-Complexes, carbonyls, nitrosyls, ethylene complexes, and sandwich-type compounds; methods of preparation, reactions, evidence for structures and type of bonding involved.

2.043A Environmental Chemistry — S2 L3T3

Prerequisites: 2.002A, 2.002D.

Physico-chemical aspects of atmosphere chemistry: dispersion of colloids and solid matter, photochemical reactions. Hydrological cycle: reactions in the sea, rivers and estuaries; chemical characteristics of surface and sub-surface waters. Corrosion of metals.

and either
Simple digital and analogue computer models of ecological systems based on chemical data and physico-chemical properties.

or
Distribution of elements and nutrient cycles in water; organic carbon cycles, oxygen balance (redox processes in aquatic systems). Chemical models of these processes (including an introduction to simple computing). Practical project (mostly field work) dealing with nutrient cycles.

Metallurgy

4.402 Physical Metallurgy 1 — S1 L3T3 S2 L2T4

Co-requisites: 2.002A, 4.502. Excluded: 1.9322, 4.412, 4.422.

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. X-ray diffraction. Phase equilibrium in alloy systems. The genesis of microstructure. Mechanisms of phase transformations, departures from equilibrium, metastable transition phases. Heat treatment of alloys. Structure of carbon steels and cast irons. Optical metallography.

4.403 Physical Metallurgy 2 — F L4T5

Prerequisite: 4.402. Excluded: 1.3033j.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Zone theory of solids — application to electrical, thermal and magnetic properties and to theory of alloys. Preferred orientation in metals. Optical, X-ray and electron metallography.

4.433 Physical Metallurgy 2C — S1 L4T5 S2 L3T3

Prerequisite: 4.402.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Optical, X-ray and electron metallography. Preferred orientation to metals.

4.512 Mechanical Properties of Solids — S1 L2T2

Co-requisite: 4.402.

The nature and significance of mechanical properties. Analysis of stress and strain. Stress/strain/time relationships. Influence of stress state, temperature, strain rate and environment on mechanical behaviour. Modes of failure under load. Mechanical testing.

4.522 Mechanical Metallurgy — S2 L1T2

Prerequisite: 4.512.

Flow and fracture in metals. Plasticity theory. Principles of metal shaping processes. Relationship between formability and conventional mechanical test results. Fracture mechanics. Fractography. Defects and their significance. Experimental methods related to stress analysis flow and fracture.

4.703 Materials Science — S2 L2T1

Co-requisite: 4.403.

The application of the principles of physical metallurgy to the development of modern materials. Particular attention is paid to the structure/property relationships that determine the design of materials. The topics covered include materials used for structural purposes, high temperature application, corrosive environments, nuclear engineering, fuel cells, magnetic applications.

4.802 Metallurgical Physics — S2 L2

Prerequisite: 1.001 or 1.011.

Development of physical principles for application in metallurgy — theory of metal models. Sommerfeld Theory, zone theory, interaction of radiation with matter, solid state devices, instrumentation.

4.913 Materials Science — FL2T1

1. The properties of crystalline solids. Defect structure of crystals. Influence of defects on the behaviour of crystals. The properties of metals and metallic alloys in terms of modern theories. The development of alloys for specific engineering applications. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials. **2.** *Metallic Corrosion. Polymer Materials:* The structure and properties of polymers. Mechanisms for the modification of properties. *Ceramic Materials:* The structure and properties of ceramics. Similarities and differences with other crystalline solids. Ceramic-metal composites.

4.964 Materials Science and Engineering for Electrical Engineers — S2 L3T1

Prerequisite: 1.982 Solid State Physics.

Metallic, ceramic, organic, polymeric and composite materials and their technology for electrical engineering applications. Structures and structure property relations, phase equilibria and their effect on mechanical, electrical, magnetic, thermal and chemical properties. The shaping, treating and joining of materials. Aqueous and gaseous corrosion. Metallic glasses, superconductors, fast ion conductors. The role of materials science in the development of electrical energy systems.

Mechanical and Industrial Engineering

5.006 Engineering E — S1 L/T6

Prerequisite: as for 5.010. Excluded: 5.010, 5.020, 5.030.

Mechanics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames, and beams. Kinetics of the plane motion of a particle, equations of motion, dynamic equilibrium, work and energy. Kinetics of systems of particles. Rotation of rigid bodies about a fixed axis. *Engineering Drawing:* Graphic communication. First and third angle orthographic projection. Descriptive geometry fundamentals and their application to engineering problems. Australian standard engineering drawing practice. *Introduction to Design:* Engineering method, problem identification, creative thinking, mathematical modelling, computer-aided design, materials and processes, communication of ideas, the place of engineering in society.

5.010 Engineering A — S1 or S2 L4T2

Prerequisite:

	HSC Exam Percentile Range Required
Either	
2 unit Science (Physics) or	*31-100*
4 unit Science (multistrand)	*11-100*
or	
2 unit Industrial Arts or	*31-100*
3 unit Industrial Arts	*11-100*

Note: Students who wish to enrol in this subject in courses other than the full-time courses in Aeronautical Engineering, Civil 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.

Statics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames, and beams. Simple states of stress. Statics of fluids. *Introduction to Engineering Design:* Engineering method, problem identification, creative thinking, mathematical modelling, computer-aided design, materials and processes, communication of ideas, the place of engineering in society. *Introduction to Materials Science:* The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.0101 Statics — S1 or S2 L2T2

Prerequisites: as for 5.010.

Statics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames, and beams. Simple states of stress. Statics of fluids.

5.020 Engineering B — S2 L4T2 or L/T6

Prerequisite: 5.0101 or 5.010 or 8.170.

Not offered in 1985.

Engineering Dynamics: Kinematics of a particle in the plane: rectilinear and curvilinear motion; motion relative to a translating frame of reference. Kinetics of a particle in the plane: Newton's second law; D'Alembert's principle; work, power and energy; belt and rope drives; gear trains. Virtual work. Kinetics of a system of particles: impulse and momentum; moment of momentum; equations of motion; impact. Fixed-axis rotation of a rigid body: angular momentum; equation of motion; moment of inertia; energy; centre of percussion. Steady mass flow: theoretical principles; Pelton wheel. *Mechanics of Solids:* Concepts of stress, strain. Stress and deformation due to axial force. Linear and non-linear problems, compound bars. Concepts of stiffness and flexibility. Bending moment and shear force in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

5.0201 Engineering Dynamics 1A — S1 or S2 L/T3

Prerequisite: 5.0101 or 5.010 or 8.170.

As for 5.020 Engineering B, *Engineering Dynamics.*

5.030 Engineering C — S1 or S2 L2T4 or L/T6 or F L/T3

Prerequisites: as for 5.010.

Engineering Drawing: Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

and one of the following options (determined by the course of study)

1. *Production Technology* — F L/T3
(Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option.) Description and appraisal of the processes classified as: forming from liquid or solid, material removal, material joining. Machines. Analysis of the primary functions of the machine tools and an appraisal of their limitations. Principles of operation of common machine tools and illustrations of their use.

2. *Introduction to Chemical Industry*
(Chemical Engineering and Industrial Chemistry students must take this option.) The chemical industry in Australia. The role of professional societies. Special topics on the engineering and chemical aspects of the industry, ie pollution control, energy sources, food and biochemicals and polymers, mineral processing, safety, etc. A visit to a factory in the Sydney area and the preparation of a short report after an introduction to information retrieval by university librarians.

3. *Introduction to Metallurgical Engineering*
(Metallurgy students must take this option.) History and significance of the exploitation of metals. Ores, mineral economics, mineral processing, and metal extraction and processing methods illustrated by reference to the Australian mineral and metal industries. Properties, uses and applications of metallic materials. The role of the metallurgist in industry and in processing and materials research, and in relation to conservation and the environment.

4. *Introduction to Mining Engineering*
(Mining Engineering students must take this option.) Mineral deposits; metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mining design and operations.

5. *Introduction to Ceramic Engineering*
(Ceramic Engineering students take this option.) The classification of materials. The nature of ceramics. The materials science approach. The scope of the ceramic industry. The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials. Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, pot forming and other forming procedures.

5.0301 Engineering Drawing — S1 or S2 L/T3

Not offered in 1985.

Fundamental concepts of descriptive geometry, including reference systems, representation of point, line and plane; fundamental problems of position and measurement. Application of descriptive geometry to certain problems arising in engineering practice. Special emphasis on ability to visualize problems and processes involved in their solution. Instruction in the correct use of drawing instruments and the appliction of drawing standards. Measurements and dimensioning. Orthographic and isometric projections.

5.0302 Engineering Drawing and Descriptive Geometry — S1 or S2 L1T3

Engineering Drawing: Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

5.0303 Workshop Technology — SS L1T2

The implementation of design and its interaction with manufacturing equipment and processes. Manufacturing capabilities and toleranc-ing. Approximately 30 hours of practical training including casting, welding, fitting and machining. Students who have done Industrial Arts for the HSC, have an appropriate trade or certificate course qualification, or are suitably employed, may qualify for exemption from this subject.

5.034 Engineering Experimentation — S1 L½T1 S2 L1T1

Prerequisites: 5.072 (Statistics Strand).

Report writing. Experimental method. Scientific method. Engineering method. Errors in experiments. Transducers. Analogue and digital instrumentation systems. Output devices. Static and dynamic instrument calibration. Dynamic signal measurement. Eleven experiments and demonstrations.

5.042 Industrial Experience

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in all BSc(Eng) courses. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

5.043 Industrial Training 1 — SS

Practical work in industry at the process or shop floor level to gain experience of people, industrial problems and relations, and process equipment. (Report submitted in Week 1 of session detailing involvement and experience gained prior to Year 3.)

For details contact Mr G. Crawford, Industrial Training Officer.

5.044 Industrial Training 2 — SS

Practical work in industry at the professional level to gain experience in design, development, investigation or management control systems areas in collaboration with professional engineers. (Report submitted in Week 1 of session detailing responsibilities and experience gained in vacation period between Years 3 and 4.)

For details contact Mr G. Crawford, Industrial Training Officer.

5.051 Thesis — F T6

Co-requisite: 5.062.

To be taken in year of completion of course.

For students in the full-time and part-time BE degree courses in the School of Mechanical and Industrial Engineering.

5.056 Mechanical Engineering — S2 L/T4

Prerequisites: 1.961 or equivalent, 10.2111, 10.2112.

Systems, reversibility, work and heat. Laws of Thermodynamics for non-flow and flow processes, entropy, process efficiency and availability. Properties of real fluids. Carnot, Rankine, Joule, Otto, Diesel and refrigeration cycles. Conduction, convection and radiation heat transfer. Design of heat sinks for transistors and other solid-state devices, and methods for derating these devices for changes in ambient conditions. Analysis of real systems; flow in adiabatic ducts, rotory machinery, steam plant, internal combustion engines, refrigeration, direct and unconventional energy conversion (fuel cells, thermoelectric power generation).

5.061 Technical Orientation — S1 L2

A series of lectures on technical topics arranged to provide an introductory background to engineering and its profession. Students are encouraged to develop their skill in observing and reporting on technical matters.

5.062 Communications — F L2

Co-requisite: 5.051

Development of skill in the use of the various media of communication. Effective interpersonal and mass communication using visual and oral transmission. Dynamics and performance of groups. Organizing and directing conferences. Chairmanship. Professional ethics and etiquette.

5.0721 Computing — S1 L1T1

Co-requisite: 10.001 or 10.011.

Introduction to digital computing equipment. Flow charting. Expressions. Conditions. Input and output. Program testing. Text editing. Programming language used is Fortran 77.

5.073 Numerical Analysis/Mathematics — F L2T1

Prerequisites: 10.022, 5.072 (Computing Strand) or 5.0721.

Numerical methods for solution of non-linear equations, linear and non-linear systems, ordinary and partial differential equations. Complex variable theory: differentiation, contour integrals, Laplace and Fourier transforms. Optimization: introduction to the Calculus of Variations; Euler-Lagrange equations and Hamilton's principle; introduction to Geometric Programming.

5.074 Computing Science for Mechanical Engineers — S1 L2T1

Prerequisite: Computing Strand of 5.072 or 5.0721.

Hardware and software: Peripheral devices and communications equipment. Program documentation, debugging and testing. Improved programming techniques. Text editors, preprocessors and debugging systems. Computer graphics. Data acquisition. Programming languages.

5.113 Mechanical Engineering Design 3 — F L1½T4½

Prerequisite: 5.112 or 5.123

Not offered in 1985.

Special analytical and experimental techniques of engineering design. Optimization; reliability analysis. Major and minor design projects.

5.121 Mechanical Engineering Design 1 — S1 L4T4 S2L3

Prerequisites: as for 5.010.

Not offered in 1985.

Engineering Drawing: Graphic communication first and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing. *Introduction to Engineering Design:* Engineering method, problem identification, creative thinking, mathematical modelling, computer aided design, materials and processes, communication of ideas. *Design for Manufacture:* The implementation of design and its interaction with manufacturing processes. Manufacturing capabilities and tolerancing. Selection of materials and processes. Approximately 60 hours of practical training, including casting, welding, fitting and machining. Project involving appraisal of an existing design and a report recommending design improvements, materials, equipment items and processes to be utilized. *Introduction to Materials Science:* The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.122 Mechanical Engineering Design 2 — F L1T2

Prerequisite: 5.030. Pre- or Co-requisites: 5.330 or 5.0201, 5.622, 5.422 or 8.112, 8.250.

Application of design strategy to creative design projects. Modelling, analysis and design of basic engineering elements and systems with further engineering drawing practice. Review of current available mechanical technology and use of standard equipment items, codes and trade literature.

5.123 Mechanical Engineering Design 3 — S1 L2T1 S2 L1T2

Prerequisite: 5.122. Co-requisite: 5.423 or 5.412.

Mathematical modelling and decision making in design with applications. More advanced design analyses, component design and drawing with individual and group projects of an interdisciplinary nature.

5.124 Mechanical Engineering Design 4

The combination of any four subjects in the sequence 5.1241 to 5.1245.

5.1241 Creative Design Project — SS T3

Prerequisite: 5.123.

This subject is concerned with the development of a feasible solution to a specified problem. The execution of the project requires attention to problem identification, creative thinking, feasibility analysis and decision making.

5.1242 Design Technology — S2 L2T1

Prerequisite: 5.122

Aspects of mechanical engineering technology which form the basis for machinery design. Hydraulic power components and circuits. Advanced welding technology. Generation of systematic strategies for design computations. Fluid couplings and torque converters. Power flow analysis in multi-path machinery.

5.1243 Machinery Design Project — SS T3

Prerequisite: 5.123

Development of the final design for a solution to a specified problem. Requires attention to design analysis, component selection, decision making, specification and the preparation of engineering drawings.

5.1244 Design Management — SS L1½T1½

Prerequisite: 5.123.

Aspects of design management which are necessary for the successful achievement of design objectives. Includes project scheduling and control, contracts, specifications, use of standards and codes, statutory controls, quality assurance, product liability, patent law, marketing. *Laboratory* deals with the evaluation of components for compliance with specification.

5.1245 Computer Based Engineering Design — S2 L2T1

Prerequisites: S1 of 5.123, 5.074, 5.423. Excluded: 18.803, 18.870G.

Design environment. Mathematical modelling: objectives and alternatives; constraints; requirements; variables; subsystems and interfaces. Assumptions and intangibles. Simplifications and validation techniques. Application: system response, evaluation of response, optimum solution. Post-solution analysis. Optimization algorithms and computer routines.

5.300 Engineering Dynamics 1B — S2 L1T1

Prerequisites: 1.001 or 1.011 or 1.951, 5.0201, 10.001 or 10.011.

Kinematics and kinetics of rigid bodies in planar motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degrees of freedom; friction; extensions to Newton's second law; D'Alembert's principle; differential equations of motion; gyroscopic couple; work and energy, variational principles; impulse and momentum, impact.

5.303 Mechanical Vibrations — S2 L1T½

Prerequisites: 5.300 or 5.330, 10.022.

Periodic motion, Fourier analysis, simple harmonic motion. Laplace Transform and phasor methods. Single degree-of-freedom system (free and forced vibrations). Some vibration-measuring instruments. Vibration insolation. Multi-degree-of-freedom systems. Systems with negligible damping, Dunkerley's formula. Introduction to beam vibrations.

5.324 Automatic Control Engineering — F L2T1

Prerequisite: 10.022

Not offered in 1985.

Laplace transforms and transfer functions. Mathematical modelling of dynamic engineering systems: block diagram methods; properties of linear elements; linearization; analysis of components and systems. Time response and stability: response of first- and second-order systems; system stability; Routh's criterion. Introduction to analog computing. Root locus method. Frequency response: the Nyquist Criterion; closed loop transient response from the open loop frequency response; Bode diagrams. Control systems: types of control action and their effects on system response; controller selection and tuning; analysis of pneumatic control system components.

5.332 Dynamics of Machines 2 — F L2T1

Prerequisite: 5.331 or 5.333.

Not offered in 1985.

Vibration of multiple degree of freedom systems. Dynamic effects in machinery. Kinematics equations of motion of spatial systems. Industrial acoustics. The plane wave equation. Transmission effects. Mufflers. The three-dimensional wave equation. Enclosures. Transmission in ducts.

5.333 Dynamics of Machines — S2 L2T1

Prerequisites: 5.300 or 5.330, 10.022.

Kinematics and dynamics of planar mechanisms: methods for the analysis of velocities, accelerations and forces in planar mechanisms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing. *Mechanical vibrations:* one degree of freedom systems, free and forced vibrations. Transmissibility and motion isolation. Whirling of shafts.

5.334 Engineering Dynamics 2 — SS L2T1

Prerequisite: 5.333 or 5.331.

Inertia effects in machinery: analysis of torsional and translational disturbances set up in machines containing one or more reciprocating masses; means of reducing or eliminating undesirable effects. *Mechanical vibrations:* two degrees of freedom systems; free and forced vibrations; applications; the undamped vibration absorber. Multiple rotor systems; free and forced torsional vibrations. Geared branched systems. Introduction to beam vibrations. Matrix methods.

5.343 Linear System Analysis — S1 L2T1

Prerequisites: 5.0201 or 5.330, 10.022.

Models of physical systems: differential equations for physical systems including mechanical, electrical, hydraulic, thermal and pneumatic systems; linearization. *System analysis techniques:* solution by Laplace transform method. Transfer functions and block diagrams. *System response:* response of first and second order sytems to impulse step, ramp, sinusoidal and periodic inputs; higher order system response; system stability, applications.

5.344 Feedback Control — S1 L2T1

Prerequisite: 5.343.

Root locus method: determiantion of root loci. Calibration of root loci. Closed loop transfer function determination. *Frequency response:* analytical determination of frequency response. The Nyquist criterion for stability. Closed loop frequency response from the open loop frequency response. Closed loop time response from the open loop frequency response. Gain settings for specified time response. Bode diagrams (logarithmic frequency diagrams). *Control systems:* types of control action and their effects on system response. Properties and applications of continuous control actions. Controller selection and tuning.

5.3541 Engineering Noise 1 — SS L2T1

Prerequisite: 5.073 (Mathematics Strand). Excluded: 5.653G.

Acoustic plane wave equation, standing waves, energy density, intensity, decibel scales. Transmission between media, absorbing materials. Mufflers. Three dimensional wave equation. Transmission in ducts. Room acoustics.

5.3542 Engineering Noise 2 — SS L2T1

Prerequisite: 5.073 (Mathematics Strand). Excluded: 5.654G.

Noise measurement, microphones, frequency analysis, transient and average measurement. Frequency weightings. Human response annoyance and damage criteria. Flow noise, noise from jets, fans, propellors. Noise of machines, modal response, damping.

5.413 Mechanics of Solids 4 — F L2T1

Prerequisite: 5.412 or 5.423.

Not offered in 1985.

Elasticity: Continuum Mechanics: Equilibrium and compatibility. Plates and shells, design of pressure vessels, rotating discs. Contact stresses. Thermal stresses. *Stress Analysis:* Experimental stress analysis. Numerical stress analysis. Use of computer packages. *Plasticity:* Laws of plastic deformation. Residual stress. Limit analysis theorems.

5.421 Mechanics of Solids 1 — S2 L2T2

Prerequisite: 5.010 or 5.0101.

Stress and strain. Bars under axial loading. Stresses and deformation due to bending. Strain energy. Flexibility and stiffness. Stress and deformation due to torsion. Helical springs.

5.422 Mechanics of Solids 2/Materials — F L2T2½

Prerequisites: 5.421 or 5.040 or 5.020 or 8.171, 10.001 or 10.011.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Statics of frames and machines. Unsymmetrical bending. Analysis of stress; analysis of strain; generalized Hooke's Law. Thin-walled pressure vessels. Combined loads. Theories of failure. Stress concentrations and fatigue. Shear stress in beams; shear centre. Stability and buckling of columns. Solidification. Mechanical processing of metals. Phase equilibrium and its application to engineering materials. Fracture, creep, corrosion.

5.4221 Mechanics of Solids 2 — F L1½T2

Prerequisites: 5.020 or 5.421 or 8.171, 10.001 or 10.011.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Statics of frames and machines. Unsymmetrical bending. Analysis of stress; analysis of strain; generalized Hooke's Law. Thin-walled pressure vessels. Combined loads. Theories of failure. Stress concentrations and fatigue. Fatigue of biaxial and triaxial systems. Shear stress in beams; shear centre. Stability and buckling of columns.

5.423 Mechanics of Solids 3 — F L1½T½

Prerequisites: 5.422 or 5.411 or 5.4221, 10.022.

Deflections of beams and structures. Statically indeterminate beams and structures. Introduction to theory of elasticity; stress, strain, torsion. Membrane analogy. Finite element stress analysis. Basic concepts; structural stiffness method; bar, triangular, rectangular and brick finite elements; force and displacement methods; development and use of computer programs.

5.424 General Mechanics of Solids — SS L2T1

Prerequisite: 5.423. Excluded: 5.417G.

Inelastic behaviour of bars, beams, shafts and columns. Thick cylinders and composite cylinders loaded by internal and external pressures; rotating discs; contact stresses. Elementary concepts of fracture mechanics; stress intensity factor; fracture toughness; crack propagation.

5.434 Plates and Shells — SS L2T1

Prerequisite: 5.423.

Bending of rectangular and circular plates under normal loading; thermal stresses. Shells; membrane stresses, bending stresses, discontinuities at juction of ends; design of pressure vessels.

5.444 Theory of Elasticity — SS L2T1

Prerequisites: 5.412 or 5.423, 5.300 or 5.330, 5.611 or 5.622.

Mathematical foundations; analysis of stress; deformation and strain; equilibrium, motion and flow; fundamental laws of continuum mechanics; linear elasticity; viscoelasticity; applications.

5.454 Theory of Plasticity — SS L2T1

Prerequisite: 5.423 or 18.413.

Analysis of stress, strain, strain rate; plastic stress/strain relations with description of experimental verification. Application of plasticity theory to a selection of problems including metal working processes such as extrusion and rolling and metallic friction and wear.

5.464 Structural Instability — S1 L1½T½

Prerequisite: 5.423.

Buckling of perfect and imperfect columns; bending and buckling of thin flat plates; local instability and crippling of thin-walled columns. Buckling of monocoque cylinders and curved panels. Stiffened panels. Tension field beams.

5.622 Fluid Mechanics/Thermodynamics — F L2T2

Prerequisites: 10.001 or 10.011; 1.951 or 1.001 or 1.011; 5.010 or 5.0101. Co-requisite: 5.300 or 5.330 (for students in Faculty of Engineering only).

Comprises 5.6221, 5.6222, 5.6223.

5.6221 Introductory Thermofluids — S1 L2T2

Not offered separately in 1985.

Work, energy, power. Units. Systems, states and processes. Flow fields; unsteady and compressible flow. Control mass and volume. Fluid properties: extensive, intensive. Equation of state. Tables of properties. First law of thermodynamics. Non flow processes: reversible, irreversible. Flow processes: energy equation, enthalpy, Bernouli's equation. Momentum equations: linear and rotational. Ideal flow.

5.6222 Fluid Mechanics — S2 L1T1

Not offered separately in 1985.

Flow measurement: orifice, nozzle, venturi meters, pitot tubes, other flow meters. Dimensional analysis: similitude, dimensionless numbers, methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent pressure loss, friction factor, losses in bends and fittings. Equations of fluid motion. Elementary boundary layer flow, skin friction and decay.

5.6223 Thermodynamics — S2 L1T1

Not offered separately in 1985.

Ideal processes and cycles, reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps, compressors, engines. Energy analysis, P-V diagrams.

5.623 Heat Transfer — SS L2T1

Prerequisite: 5.611 or 5.622; 10.022.

Conduction: steady one and two dimensional; unsteady one dimensional. Radiation: properties; shape factor; compound surfaces. Convection: laminar and turbulent boundary layers and heat transfer; flow in ducts and pipes; natural convection. Design of heat exchangers.

5.624 Refrigeration and Air Conditioning — SS L2T1

Prerequisite: 5.611 or 5.622. Co-requisite: 5.623, 10.022.

Psychrometry and air conditioning calculations, heat load, estimates, vapour compression, absorption and air cycle refrigeration, refrigeration and air conditioning systems and components, cryogenic cycles.

5.633 Turbomachines — SS L2T1

Prerequsites: 5.611 or 5.622; 10.022. Co-requisites: 5.073, 5.663.

Dimensional analysis and experience charts, cavitation, thermodynamics of a stage, blade element theory of axial machines, thin wing theory, cascade data and design procedures, aerodynamic design of an axial machine, theory of centrifugal machines, design of a centrifugal machine.

5.6341 Viscous Flow Theory — F L/T1½

Prerequisite: 5.611 or 5.622; 10.022.

Review of vector analysis and Cartesian tensors. Kinematics of fluid motion. Reynolds transport theorem. Stress in fluid motion. Cauchy's equation. Constitutive equations. Couple stresses. Dynamics of fluid motion. Navier-Stokes equations. Linear and angular momentum equations. Inviscid motion. Thermodynamics of fluid motion. Energy equation. Energy transfer equation. Dissipation function. Enthalpy and entropy. Crocco's, Bjerkne's and Kelvin's theorems. Turbulent motion. Time smoothing. Time smoothed equations of fluid motion. Vortex transport equation. Creeping flow. Similarity.

5.6342 Lubrication — SS L/T3

Prerequisite: 5.611 or 5.622; 10.022. Excluded: 5.631G.

History of lubrication, types of bearings and bearing operation, nature of surfaces and their contact, modes of lubrication, properties of lubricants, viscous flow in pipes and channels, measurement of viscosity, infinitely long and short bearing approximations, one-dimensional analysis of short bearing, other slider bearing geometries, the effect of end leakage, hydrostatic or extremely pressurized bearings, squeeze films.

5.635 Convection Heat Transfer — SS L2T1

Prerequisite: 5.623.

Conservation of energy, momentum and mass. Friction and heat transfer on surfaces with laminar boundary layers: similarity and integral methods, influence of fluid Prandtl Number, relations for Nusselt and Stanton numbers. Natural convection boundary layers. Turbulent boundary layers: laminar and turbulent sub-layers, law of the wall, analogies between friction and heat transfer. Friction and heat transfer inside tubes: laminar and turbulent flow, relation between friction and heat transfer.

5.643 Thermodynamics and Combustion — SS L2T1

Prerequisite: 5.611 or 5.622; 10.022. Co-requisite: 5.653.

General thermodynamic relations, ideal and non-ideal gases, statistical thermodynamic derivations of internal energy and entropy, ideal gas mixtures. Combustible fuels, combustion equations, internal energy and enthalpy of reaction. First law analysis of combustion, adiabatic flame temperatures. Second law analysis of combustion, chemical equilibrium, chemical kinetics and rate controlled reactions. Application of chemical equilibrium and reaction rate methods to combustion and emission problems. Deflagration, detonation and diffusion flames, mixing controlled reactions.

5.644 Solar Energy — SS L2T1

Prerequisite: 5.611 or 5.622; 10.022, Co-requisite: 5.623.

Radiation heat transfer, spectral distribution of solar radiation and effect of atmospheric absorption. Solar radiation data, total and diffuse components. Analysis of heat transfer processes in solar collectors. Evaluation of performance. Descriptive treatment of indirect methods of use of solar energy.

5.653 Compressible Flow — S1 L2T1

Prerequisite: 5.611 or 5.622; 10.022.

Part **1.** below is compulsory for Aeronautical Engineers and forms a component of 5.811 — (7 weeks only).
1. One dimensional steady flow: isentropic channel flow, normal shock waves, supersonic wind tunnels and diffusers, flow visualization. **2.** Two dimensional steady flow: oblique shock waves, Prandtl-Meyer expansions, nozzles, airfoils. **3.** One dimensional unsteady flow: moving waves, reflections, explosions in ducts, shock tubes; method of characteristics, internal flows, piston and valve effects.

5.654 Hydraulic Transients — SS L2T1

Prerequisites: 5.611 or 5.622; 10.022.

Mass oscillations in surge systems with various types of surge tanks. Stability of surge systems, comparison with experiment. Allievi's theory of water hammer, fast and slow closures, water hammer in pumping systems, circle diagrams.

5.663 Potential Flow Theory — S1 L2T1

Prerequisite: 5.611 or 5.622; 10.022. Co-requisite: 5.073. Excluded: 5.811.

Introduction and basic concepts. Kinematics of irrotational flow and equations of continuity for an incompressible fluid. Stream function and use of distributed singularities to generate arbitrary body shapes. Airfoils and hydrofoils. Added mass for simple two dimensional shapes. Plane progressive water waves in both deep water and in water of finite depth.

5.664 Multiphase Flow — SS L2T1

Prerequisite: 5.611 or 5.622; 10.022.

Nature of multiphase flow. Gas-liquid, gas-solid, liquid-solid two phase and two-component flows. Three-phase flows. Vertical and horizontal flows. Flow patterns. Correlations. Pressure drop in two-phase flows. Isothermal flows. Flows with heat transfer. Hydraulic and pneumatic transportation of solid materials in pipelines.

5.800 Aircraft Design 1 — F L2T1

Prerequisites: 5.122 or 5.111; 5.300 or 5.330; 5.422 or 5.411. Co-requisites: 5.423 or equivalent.

Aircraft and helicopter types, materials, loads, load factors. The design process. Design of members in tension, compression, bending, torsion; rivetted, welded and bolted joints. Wing lift distribution, stressing, design and drawing of components, fittings. Analysis and design of composites, sandwich construction. Applications of finite element method. Helicopter rotor control, loading.

5.801 Aircraft Design 2 — F L2T1

Prerequisites: 5.303, 5.412 or 5.423; 5.800; 5.811; 5.822. Co- or prerequisite: 5.812, 5.823, 5.831.

A co-ordinated course of lectures in aerodynamics, structures and operations leading to detailed design, calculation and drawing of an original aircraft configuration.

5.811 Aerodynamics 1 — F L2T1

Prerequisites: 5.300 or 5.330, 5.611 or 5.622; 10.022. Excluded: 5.653.

1. Compressible flow: See Part **1.** of 5.653 (7 weeks only). **2.** Low speed aerodynamics: boundary layers, drag; industrial aerodynamics, wind tunnels, airfoils for wings, cascades, propellers, fans; potential flow for airfoils; Prandtl lifting lines, vortex induced drag. **3.** Flight mechanics: performance; static stability.

5.812 Aerodynamics 2 — F L2T1

Prerequisites: 5.073; 5.612 or 5.811; 5.303 or 5.331 or 5.333 or 5.334; 5.343.

1. Compressible flow: subsonic, transonic and supersonic two-dimensional flows; viscous boundary layers and heat transfer. **2.** Dynamic stability and control: characteristic solutions for rigid aircraft. **3.** Hypersonic, high enthalpy flows.

5.822 Analysis of Aerospace Structures 1 — F L1½T½

Prerequisites: 5.300 or 5.330; 5.411 or 5.422; 8.259; 10.022. Co- or prerequisite: 5.412 or 5.423.

Equilibrium of forces: aerospace applications of plane frames and space structures. Beams; shear and bending stress distribution in thin-webbed beams, close-section thin-wall beams, tapered beams, beams with variable flange areas. Semi-monocoque structures; ribs and bulkheads. Deflection of structures: stresses due to torsion and shear in multicell tubes. Statically indeterminate structures; beams, trusses and frames. Structural instability; buckling of perfect and imperfect columns; bending and buckling of thin flat plates.

5.823 Analysis of Aerospace Structures 2 — F L1½T½

Prerequisites: 5.412, 5.423, 5.822.

Structural instability; local instability and crippling of thin-walled columns; buckling of stiffened panels, curved panels and monocoque cylinders; tension field beams. Stress functions. Shear lag. Warping of thin-walled open and closed section tubes. Torsional buckling. Advanced applications of finite elements; introduction to commercial f.e.m. systems. Thermal stresses. Vibrations. Fatigue.

5.831 Aerospace Propulsion — F L1½T½

Prerequisites: 5.611 or 5.622; 5.653 or 5.811.

Propulsion systems: history, types, basic thrust, efficiency equations. Propellers, rotors and fans: engine cycle thermodynamics, performance, testing. Engine intakes: subsonic, supersonic, ramjets. Gas turbine, piston engine, design, performance. Rockets. Noise, pollution.

5.901 Introduction to Mathematical Modelling and Decision Making — S1 L2T1

Prerequisite: 5.122 or 5.111.

This subject is identical with Session 1 of 5.123.
Models and modelling: types, criteria, parameters, constraints; mathematical formulation and validation of models; fundamentals of solution algorithms; post-solution analysis. Decision making: scales and ratings; subjective decision making; mixed rating comparisons; sensitivity; pitfalls. Introduction to project control. Applications from the marine field.

5.902 Ship Management Economics — S2 L1½T½

Prerequisite: 10.022. Co- or prerequisite: 5.071 or 5.073.

Basic concepts and definitions. Interest relationships. Present worth. Average annual cost. Capitalized cost. Rate of return. Depreciation and taxation. Economic criteria. Voyage analysis. Probability in economic studies. Sensitivity analysis in economic studies. Introduction to dynamic programming. Replacement analysis of equipment, ships and shipyards.

5.911 Ship Hydrostatics — F L2T½

Prerequisite: 5.010 or 5.0101.

Basic concepts and integration methods. Hydrostatic particulars and approximate formulae. Intact stability, cross curves and righting arm, stability at small angles and free surface effects, the wall-sided formula, flooding and water tight subdivision. Damaged stability. Launching calculations and docking.

5.921 Ship Structures 1 — F L1½T½

Prerequisites: 5.422 or 5.411; 10.022.

Ship structural loading and response. Bending of the hull girder — deterministic aspects. Statistical prediction of wave loads and whole girder response. Basic concepts in finite element analysis — extended beam theory. Applications of extended beam theory — hull girder analysis. Frame analysis and applications in ship structures. Ultimate strength of beams and frames. Laterally loaded grillages and stiffened panels — elastic and ultimate strength analysis.

5.922 Ship Structures 2 — F L1½T½

Prerequisites: 5.423 or 5.412; 5.921.

Plate bending — elastic and ultimate strength analysis. Orthotropic plate bending and applications. Buckling and ultimate strength of columns. Buckling and ultimate strength of plates. Buckling of stiffened panels. Ultimate strength of stiffened panels. Ship structural materials, fatigue, fracture. Geometric stress concentration. Welded connections. Pressure hulls. Ultimate strength of hull girder. Structural optimization methods. Automated and computer aided design.

5.9311 Principles of Ship Design 1 — S2 L2T1

Development of ships and ship building. Ship structure and lines. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard and tonnage. Ship design.

5.9321 Principles of Ship Design 2 — S1 L3T1 S2 L1½T½

Prerequisite: 5.9311.

Theory and technique of ship design. Blocking out a ship's dimensions. Development of weights. General arrangements, depth, freeboard capacity, stability analysis. Preliminary powering, sectional area curve and lines drawing. Estimating, design for construction, ship economics. Classification rules with scantling development. Midship section drawing. Safety and protection of ships. Rudders, trials, manoeuvring, cargo gear, shipbuilding methods production and control. Computerized costing, modular construction, tendering, production concepts, shipyard management.

5.933 Principles of Ship Design 3 — F L2T1

Prerequisite: 5.932.

Theory and technique of ship design. Development of ship's lines. Design criteria and data. Criteria of statutory bodies relating to design. Details of ship's structure. Rudders and steering arrangements. Structural design requirements of classification societies. Ship arrangements and equipment. Specifications. Modern shipbuilding methods and prefabrication. Ship operation economics.

5.934 Ship Design Project — S1 T3 S2 T4½

Prerequisites: All subjects in Years 1, 2 and 3. Co- or prerequisites: 5.922, 5.933, 5.941.

Design of a vessel to provide characteristics of hull form, preliminary general arrangement, lines plan, hydrostatic curves, investigation of stability and trim, structural profile and midship section, capacity, freeboard, tonnage, floodable length (if applicable), power requirements, propeller design, investigation of vibration, rudder design and final general arrangements.

5.937 Ship Design Project — S1 T3 S2 T4

Prerequisites: 5.901, 5.911, 5.953.

Each student is required to perform the following design tasks and submit the results: **1.** Rationale, specifications, weights, inboard profile. **2.** Power, capacities, freeboard, trim, stability, stern gear. **3.** Sectional area curve, lines drawing, prelim midship section. **4.** Hydrostatics, floodable length and stability curves. **5.** Powering, propeller, systems-schematic drawing, detailed capacity. **6.** Section modulus calculation, bulkhead, midship section, module concept. **7.** Final weights, capacity drawing, operational data, and evaluation.

5.941 Ship Propulsion and Systems — F L/T4

Prerequisites: 5.911, 5.953.

Ship resistance. Problems of modelling, Froude's Method and improvements laboratory tests. Viscous resistance, wave resistance, and other components of drag. Propulsion. Propeller terminology and momentum theory. Experiments. Design and selection of propellers. Cavitation and vibration. Manoeuvring. Theory of ship manoeuvrability. Linearized equations of motion. Determination of coefficients and trials. Rudder design. Marine Engineering systems. Steam, diesel, gas turbines, turbo and diesel electric, nuclear propulsion. Systems for fuel, transmission, electricity, pumps, compressors, purifiers, piping systems and automation.

5.953 Ship Hydrodynamics — S1 L2T1 S2 L1½T½

Prerequisites: 5.330 or 5.330; 5.611 or 5.622; 10.022. Co-requisite: 5.073.

1. 5.663 (Potential Flow Theory) in Session 1. **2.** 5.952 (Hydrodynamics) in Session 2. Introduction and elementary methods applied to ship hydrodynamics. Dimensional analysis and experimentation. Motion of a spar buoy and derivation of coefficients in equation of motion. Linearized uncoupled motion of a ship. Non-linear aspects. Coupled heave and pitch motion of a ship. Ocean waves and their properties.

Electrical Engineering and Computer Science

6.010 Electrical Engineering 1 — S2 L2T4

Prerequisite: Electricity and magnetism section of 1.961.

Prepares students for the various areas and disciplines of Electrical Engineering. Includes field and circuit theory; electronics; logic circuits; communications; energy conversion; automatic control. Laboratory exercises and project work are major components.

6.021A Circuit Theory 1 — S1 or S2 L2T2

Prerequisites: 1.961 or equivalent, 6.010, 10.001.

Lumped modelling concepts used in circuit theory and their relationship to observed physical properties and behaviour. Linear circuit elements. Kirchhoff's Laws. Resistive network topology and systematic derivation of network equations using node and loop methods. Network theorems. Exponentials and first order transients. Sinusoidal steady state operation including phasors, impedance and admittance concepts and systematic circuit equations. Power relations and second order systems response. Resonance, Q factor and bandwidth. Three phase circuits. Controlled sources and two port analysis.

6.021B Power — S1 or S2 L2T2

Prerequisite: 6.021A attempted at an acceptable level.

An introduction to the transmission, distribution and utilization of electrical energy, including devices which use the interaction of electric, thermal and magnetic fields. Topics include three-phase circuit analysis, magnetic circuits, transformers, and basic electromechanical energy conversion.

6.021C Electronics 1 — S1 or S2 L2T2

Prerequisite: 1.982, 6.021A (one of these to be passed, the other to be attempted at an acceptable level and to be repeated concurrently).

Principles of operation and low-frequency characteristics of PN diodes, bipolar and field effect transistors, thyristors and various optoelectronic devices. Transistor low-frequency small-signal equivalent circuits. Design and analysis of low frequency Class A transistor amplifiers. Temperature effects. Device ratings and use of data sheets.

6.021D Computing — S1 or S2 L2T2

Prerequisite: 6.611. Excluded: 6.600, 6.620, 6.621.

Assembler programming and simple machine architecture. The Unix operating system: file system, processes, pipes, programming in the Shell command language. Data structures: lists, trees, recursion. Sorting: some basic algorithms for sorting arrays. Engineering applications of computers.

6.021E Digital Logic and Systems — S1 or S2 L2T2

Prerequisite: 10.001.

Combinational circuits. Karnaugh maps. Sequential circuits. Register design. MOSFET circuits. Logic families. Memory elements. Computer magnetic storage devices. MSI/LSI functions. Computer operation. Numbers, codes, arithmetic, standards.

6.0311 Circuit Theory 2 — S1 or S2 L2T2

Prerequisites: 6.021A, 10.111A (10.111A if attempted at an acceptable level may be taken as a co-requisite), 10.1113, 10.1114, 10.2111, 10.2112 (two of these may be taken as co-requisites), 6.021B, 6.021C (one of 6.021B or 6.021C may be taken as a co-requisite).

Basic circuit concepts followed by basic system ideas such as order, state, linearity and typical system waveforms. Typical linear time invariant systems modelled and described by differential equations leading to use of Laplace transforms. Partial fractions, poles, zero and stability. Transfer functions and circuit responses both in time and frequency domain. Basic signal analysis. Fourier series. Fourier Transform. Modern filter design, Butterworth and Chebysher filters. Transformation of low pass filter to high pass, bandpass and band stop filters.

6.0312 Utilization of Electric Energy — S1 or S2 L2T2

Prerequisites: 6.021A, 6.021B. Co-requisite: 6.0311.

A continuation of study in the utilization of electrical energy commenced in 6.021B Power. Topics include: dc machines, synchronous machines, single- and three-phase induction motors, fractional horsepower motors, motor speed control, performance characteristics and applications, the thermal behaviour and rating of machines, harmonics in three-phase transformers.

6.0313 Electronics 2 — S1 or S2 L2T2

Prerequisites: 6.021A, 6.021C. Co-requisite: 6.0311.

Review of basic transistor theory and properties. Design and analysis of small signal amplifiers incorporating bipolar junction transistors and operational amplifiers. Applications of negative feedback. Differential amplifiers. Structure, properties and use of operational amplifiers. Tuned amplifiers.

6.0314 Systems and Control 1 — S1 or S2 L2T2

Prerequisite: 6.0311.

An introductory overview of systems and control, with examples from modern industrial and scientific practice. Dynamic systems modelling. Time and frequency domain relationships. Block diagrams. Feedback theory and sensitivity. Operational amplifier systems. Simulation of systems by analog and digital computers. Stability theory. Nyquist theorem. Routh test. Root locus.

6.0315 Electrical Energy — S2 L2T2

Prerequisite: 1.972; 6.0312 attempted at an acceptable level.

Aspects of the supply, control and utilization of electrical energy. Choice of voltage and supply configuration. Transmission line characteristics and calculations. Dielectric and thermal considerations of power equipment. Protection considerations for medium voltage (up to 600V) systems — circuit breakers, fuses, relays, earthing, surge suppression. Electrical methods of industrial heating: direct, induction, dielectric, etc. Light sources, their operation and efficacy. ac-dc conversion, power switching devices, their characteristics and uses.

6.0316 Electronics 3 — S1 or S2 L2T2

Prerequisite: 6.0313. Co-requisites: 6.0311, 6.021E.

Extension of 6.0313 Electronics 2 to include oscillators, large-signal electronics of bipolar and field-effect transistors, charge-control switching analysis for bipolar and field-effect transistors, power amplifiers, waveform generators and shapers, monostables, astables, and an introduction to digital electronics, with an increasing emphasis on integrated circuit realizations.

6.0317 Communication Systems 1 — S2 L2T2

Prerequisite: 6.0311. Co-requisite: 10.361.

Overview of information acquisition, transmission and processing. Aims to enable students not specializing in this field to understand the communication problems they are likely to meet in their career, and to provide a background if they intend to specialize in communications.

Topics: analogue to digital conversion (sampling, quantizing, aliasing, pulse code modulation, delta modulation, time and frequency division multi-plexing). Modulation and demodulation (amplitude, frequency and phase modulation, signal to noise ratio, noise figure, error probability, bandwidth, spectrum, intersymbol interference). Communication systems (transmission lines, radio wave propagation, antennas and arrays, modems, repeaters, equalizers, line and error coding).

6.0318 Microprocessor Systems and Applications — S1 or S2 L2T2

Prerequisites: 6.021D or 6.620, 6.021E or 6.631, 6.021C attempted at an acceptable level. Excluded: 6.613.

Basic computer architecture: fetching and executing instructions; Motorola 6809 registers and instructions; assemblers, addressing modes; bus waveforms; interfacing to a bus; parallel interfacing — the PIA; handshaking; interrupts; critical regions; buffered I/O; stack data frames; translating from Pascal to assembler; recursion; serial interfacing — the ACIA; direct memory access (DMA); dynamic memory; memory management; timer chips; VLSI aspects of microprocessor chip design.

6.041 Electrical Measurements — SS L2T3

Prerequisites: 6.0311, 6.0313.

A course of lectures and laboratory work of one session's duration treating basic electrical measurements using null or deflection techniques with analog or digital presentation in the range from DC to an upper frequency limit where lumped circuit techniques begin to be inadequate.

6.042 Digital and Analogue Signals — S1 L2T3

Prerequisites: 6.0311, 10.033, 10.361.

Analysis and processing of continuous-time and discrete-time (digital) signals: Generalized Fourier analysis; convolution, correlation, energy and power density spectra. Signal distortion (linear and nonlinear) Hilbert transforms; analytic signals, signals in systems. Sampling and digital processing of analogue signals; the discrete Fourier transform (DFT), the fast Fourier transform (FFT), algorithm. Design of finite and infinite impulse response (FIR and IIR) digital filters. Analysis of random signals and noise; transmission through linear systems and nonlinear devices, signal-to-noise ratios, matched filters. Estimation and measurement of power density spectra.

6.044 Electrical Product Design and Reliability — S2 L2T3

Prerequisite: 10.361.

The design and development of reliable, high-quality hardware, from components to systems: product and procurement specifications; factors in choice of system configuration, materials, components, processes, prediction of reliability, availability, system effectiveness; cost-of-ownership optimization; maintainability; thermal design; mechanical design; redundancy; design reviews; fault-free analysis; failure mechanisms; failure mode analysis; Monte Carlo simulation; worst case and statistical design; sensitivity analysis and marginal testing; component screening; product development; life testing, environmental testing, non-destructive testing, quality control, attribute sampling.

6.202 Power Engineering — Systems 1 — S1 L2T3

Prerequisites: 6.0312, 6.0315.

An elective emphasizing parameters and performance of power system components; transmission lines and cables, transformers, synchronous machines; power system overvoltages; fault calculations; circuit interruption; protection; distribution systems; power system economics.

6.203 Power Engineering — Systems 2 — S2 L2T3

Prerequisite: 6.202.

Emphasis on interconnected system operation, performance and control. Digital computer techniques for power system analysis. Review of topics in numerical analysis, simultaneous linear and nonlinear equations, numerical integration, sparsity programming techniques. Load-flow. Short-circuit analysis. Steady-state and transient stability analysis. Harmonics.

6.212 Power Engineering — Utilization — S2 L2T3

Prerequisites: 6.0312, 6.0315.

Topics include: Power electronics; scope of power electronics, commutation, filtering and harmonics, thyristor protection, AC phase control, integral cycle control, rectification, inversion, bridge converters, converter control, dual converter, cyclo-converter, DC switching and regulation. Electrical machines; application and control; unified machine theory; application of symmetrical component theory to the operation of induction motors. Electrical equipment for hazardous atmospheres. A program of experimental projects and design applications accompanies the lectures.

6.222 High Voltage Technology — S1 L2T3

Prerequisite: 6.0315.

An elective concerned with the high voltage design and testing of electrical equipment used in the power industry. The practical applications of relevant materials, with emphasis on properties of insulation systems (gases, liquids and solids) and to the interaction of the materials in non-uniform fields. Methods of testing under steady state — ac and dc — and surge conditions are incorporated in the laboratory work. Design examples are taken from insulator, bushing, cable, power capacitor, transformer, rotating machine and switchgear technologies.

6.303 Transmission Lines for Microwave and Optical Communication — S1 L2T3

Prerequisite: 6.0317.

Ray theory of multimode Optical Fibre. Two-conductor transmission lines and microstrips. Smith Chart and stub matching transients on transmission line.

6.313 Signal Propagation at Microwave and Optical Frequencies — S2 L2T3

Prerequisite (or co-requisite): 6.303.

Maxwell's Equations, wave guides, optical fibres, free space propagation, antennas, sources.

6.322 Electronics 4 — S1 or S2 L2T3

Prerequisites: 6.0313, 6.0316.

Theory and applications of electronic devices, circuits and systems employing microelectronics technology. Active filters, voltage-controlled oscillators, phase-locked loops, switching regulators. Additional topics chosen from: digital ICs using MOS logic, charge-coupled devices, voltage references and optical links. *Laboratory:* a series of projects to design, construct and study circuits based on the above topics.

6.323 Communication Systems 2A — S1 L2T3

Prerequisites: 6.0317 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 10.033, 10.361.

Theory and practice of modern analogue and digital communication techniques. Topics include: Digital signals (bandlimited signalling, Nyquist and partial response shaping, non-binary transmission, receiver optimization and matched filters, line coding, spectrum with line coding, adaptive equalization, error control coding, discrete and continuous channel capacity); linear and nonlinear analogue modulation (AM, SSB, FM, etc, signal to noise ratios, characterization and effect of nonlinearities on transmitters and receivers, comparison); aspects of transmission media relevant to telecommunication systems.

6.333 Communication Systems 2B — S2 L2T3

Prerequisites: 6.0316, 6.0317.

Modern digital and analogue communications systems from a systems point of view. Topics include: television, teletext and viewdata; acoustic systems; broadcast systems covering AM, FM, stereo; radar, sonar, electronic navigation aids; satellite communication systems; point-to-point terrestrial communication systems.

6.402 Introductory Physiology for Engineers — S1 L2T2

An introduction to biophysics and physiology for engineers. Cells, tissues and organ systems with emphasis on their functional and regulatory characteristics and their interaction. An introduction to computer models of physiological control systems demonstrating their value in understanding the dynamics of complex neural, hormonal and circulatory responses to changes in homeostasis.

6.412 Systems and Control 2 — S1 L2T3

Prerequisites: 6.0311, 6.0314.

The design of feedback controllers for single and multivariable systems typically encountered in electrical engineering. Emphasis on satisfying steady-state, transient and sensitivity specifications by both frequency domain and time domain techniques. Treatment of identification methods and nonlinearities via the describing function. Extensive use of interactive computer-aided design programs.

6.413 Digital Control — S2 L2T3

Prerequisite: 6.0314 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 10.033, 10.361.

The design and analysis of digital control systems. Consideration of problems in analog-digital and digital-analog conversion such as quantization, aliasing and finite word length and their relation to the design of numerical control algorithms. On-line digital identification and adaptive control techniques as illustrated by the self-tuning regulator, minimum variance and dead beat control structures.

6.432 Computer Control and Instrumentation — S1 L2T3

Prerequisites: 6.0314, 6.0316, 6.0318 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject).

Current practice in hardware and introduction to software techniques as applied to the implementation of control and instrumentation systems. Analog computers and associated circuit techniques. Transducers, actuators, controllers and special electro-mechanical devices as used in industrial instrumentation. Digital instrumentation. Hybrid devices and analog conversion. Sampling. Computer control organization and interfacing concepts. Microprocessor peripherals, including display systems, and magnetic data storage devices. Bus communication system for instrumentation. Programmable logic controllers. Standard process control configurations. Introduction to software systems for digital control applications. Computer control of processes via on-line languages. Includes a significant laboratory program aimed both at illustrating the lecture material and introducing new concepts.

6.483 Biomedical Engineering — S2 L2T3

Prerequisites: 6.0314, 6.0316, 6.402.

A course designed to introduce electrical engineering students to the practice of engineering techniques applied to the biological and medical fields. The lectures are supplemented by demonstrations and experimental work, and deal with medical instrumentation and measurement techniques and modelling of various types of biological systems.

6.512 Semiconductor Devices — S2 L2T3

Prerequisite: 6.0313.

Principles of operation and circuit characteristics of a range of semiconductor devices including bipolar diodes and transistors, MOS devices and circuits, charge-coupled devices, solar cells, light-emitting diodes, and semiconductor lasers. The lectures are supplemented by experimental work with these devices.

6.522 Transistor and Integrated Circuit Design — S1 L2T3

Prerequisites: 6.0313, 6.0316.

Review of IC Technology. Development of circuit models for bipolar and MOS devices. Relationship of model parameters to processing, design and physics. The use of CAD programs (eg SPICE) in circuit simulation. Design studies of selected IC functions chosen from: bipolar and MOS operational amplifiers, analog multipliers, D/A and A/D converters, STTL and MOS logic. *Laboratory:* studies of the internal design and performance of selected ICs, plus the use of the School's CAD facilities to carry out a design project.

6.532 Integrated Digital Systems — SS L2T3

Prerequisites: 6.021E, 6.0316.

Integrated circuit logic families, transmission line behaviour of interconnections, gate arrays, structured chip design, system architecture, computer aided design, layout considerations, timing estimates, design for testability.

6.606 Computing Science Honours

6.611 Computing 1 — S1 or S2 L3T3

Prerequisite: As for 10.001. Co-requisite: 10.001 or 10.011. Excluded: 6.600, 6.620, 6.021D (1.041 excluded for students enrolled in Program 6806 and Computer Science programs in the Science and Mathematics course).

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.

6.612 Computer Organization and Architecture — S1 L3T2

Prerequisite: 6.0318 or 6.613.

The structural organization and hardware design of digital computer systems, basic computer organization, control and microprogramming, arithmetic algorithms and processor design, memory management and organization, input-output systems, parallel processing and multiprocessor systems. Use of algorithmic state machines for digital system description, specification and design.

6.613 Computer Organization and Design — S2 L2T3

Prerequisites: 6.631 or 6.021E, 6.021D or 6.620 or 6.621 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects).Excluded: 6.0318.

Bussing structures (asynchronous and synchronous); input/output organization; polling, interrupt and DMA control; parallel and serial device and processor communication and interfacing. Memory organization; CPU and control unit design. Processes: synchronization and communication. Microprocessor case studies.

6.621 Computing 2A — S1 or S2 L3T2

Prerequisites: 6.611 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 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.

6.622 Computer Applications — SS L3T2

Prerequisite: 6.641. Excluded: 6.646, 6.633.

Simulation: discrete event simulation, pseudo-random number generation, simple queueing theory. Non-numeric programming: artificial intelligence, symbolic computing. Database systems: data base models: relational, hierarchical and network structures; query languages; case study of Ingres; data base security.

6.631 Computing 2B — S1 or S2 L3T2

Prerequisites: 6.620 or 6.621 or 6.021D (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects), 6.600 (CR). Excluded: 6.021E.

Assembler programming: programming in a low level machine oriented language in order to illustrate the mapping of higher level language constructs onto a typical machine and the interaction between operating systems and devices. *Digital Logic Design:* Boolean algebra and logic gates, simplification of Boolean functions, combinational logic, medium scale integration building blocks, clocked sequential circuits, registers and memory, computer arithmetic.

6.632 Operating Systems — S1 L2T3

Prerequisites: 6.631 or 6.021E, 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects). Excluded: 6.672.

Introduction to operating systems via an intensive case study of a particular system, namely the UNIX Time-sharing system which runs on the PDP11 computer. Includes system initialization, memory management, process management, handling of interrupts, basic input/output and file systems. A comparison of UNIX with other operating systems. General principles for operating system design.

6.633 Data Bases and Networks — S2 L3T2

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded: 6.622, 6.652, 14.608, 14.607.

Data Base Management Systems: data models; relational and network structures; data description languages; data manipulation languages; multi-schema structures. Data integrity and security; recovery; privacy. *Computer Networks:* economic and technological considerations; digital data transmission; error detection and recovery; network configurations; circuit switching, packet switching; communication protocols, current international standards; data compression; encryption and decryption.

6.641 Computing 2C — S1 or S2 L3T2

Prerequisites: 6.620 or 6.021D or 6.621 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects), 6.600 (CR).

Design of Data Structures: abstraction, representation, manipulation and axiomatization. Key transformations (hashing), balanced and multiway trees, introduction to graphs. *Files:* sequential access, random access, merging, sorting and updating. File organizations and introduction to data base systems. *Programming in Logic:* descriptive programming languages, symbolic manipulation, pattern matching and associative programming. *Software Engineering:* a survey of some current techniques in problem specification and program design.

6.642 Design and Analysis of Algorithms — S1 L3T2

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject).

Techniques for the design and performance analysis of algorithms for a number of classes of problems. Analysis of algorithms: order notation, recurrence equations, worst case and expected order statistics. Design of efficient algorithms: recursion, divide and conquer, balancing; backtracking algorithms, branch and bound, dynamic programming; set manipulation problems; fast search algorithms, balanced optimal and multiway trees; graph representations and algorithms; pattern matching algorithms. NP — complete problems. Design and specification of programs: modularization, interface design, introduction to formal specification techniques.

6.643 Compiling Techniques and Programming Languages — S1 L3T2

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded: 6.672.

1. Language description: phrase structure grammars, Chromsky classifications, context-free grammars, finite state grammars, Backus Naur Form, syntax graphs, LL(k), LR(k), LAL(k). **2.** Lexical analysis: translation of an input (source) string into a (machine independent) quasi-terminal symbol string. Finite state recognizers. **3.** Syntax analysis: top-down compilation for LL(1) grammars using syntax graph driven analysers or recursive descent. Bottom-up compilation for simple- and weak-precedence and LR(k) grammars. **4.** Semantic analysis: program translation and code generation; attributed grammars. **5.** Compiler generators: automatic generation of compilers for LALR(1) grammars. **6.** Code optimization by systematic program transformation. **7.** Run-time organization: activation record stacks, heap management.

6.646 Computer Applications — S1 L3T2

Prerequisites: 6.620 or 6.021D or 6.621 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects), or 6.600 (CR), one of 10.311A, 10.321A, 10.301, 10.331, 45.101 or equivalent. Excluded: 6.622.

The use of computers for solving problems with a substantial mathematical and operational research content: includes use of some standard software packages. Topics selected from: discrete event simulation; a simulation language; pseudo random number generation; simple queueing theory, applications of mathematical programming; dynamic programming; statistical calculations; critical path methods; computer graphics, artificial intelligence.

6.647 Business Information Systems S2 L3T2

Prerequisites: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 14.501. Excluded: 14.603, 14.602, 14.605.

Introduction to accounting systems — general ledger, debtors and creditors; models of business information systems; integrated business systems. System specification, system analysis, system design and implementation; testing and debugging. Managing a project team, project control. The COBOL programming language. File organization and design; sequential, indexed sequential, random, inverted, B-tree file organizations; data dictionaries, program generators, automatic system generators. A major project, written in COBOL, is undertaken as a team exercise.

6.649 Computing Practice S2 L3T2

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Co-requisites: 6.633 or 6.643 or 6.647.

Not offered in 1985.

Can only be counted with at least 3 other Level III Computer Science units.

For students majoring in Computer Science who seek a programming career in government or commercial industry. Topics, related to current computing practice, include: Comparative study of computer hardware in current popular use; Comparative study of the 'popular' programming languages, eg COBOL, RPG, BASIC, FORTRAN, PL/1, APL. Job control languages. Data Preparation procedures. Keyboard entry. Verification. Word processing; report preparation; documentation. Social implications of computing. Professional responsibilities and ethics. Project management; software engineering; psychology of computer programming.

6.652 Data Communication and Computer Networks S2 L2T3

Prerequisites: 6.0318 or 6.613, 6.0317. Excluded: 6.633.

Principles of data networks. Protocols. Data transmission on telephone networks, national data networks. Local area networks and their interconnection. ISO reference model with particular reference to the physical layer, data link layer and network layers. Contention and token passing systems. Channel capacity, queuing problems, noise and handling errors. Data in mixed traffic environment. Services. Computer communications (synchronous and asynchronous). Arbitration and synchronization. Hardware/software communication models. Operating systems views of communication. Error detection and recovery, computer networks. There is a laboratory component.

6.672 Operating Systems and Compilers SS L3T2

Prerequisites: 6.0318 or 6.613, 6.641. Excluded: 6.643, 6.632.

Operating Systems: properties of a real time virtual machine; implementation of a real time virtual machine; scheduling; reliability; processes for the virtual machine; system programming, performance measurement. *Compilers:* language description; phrase structure grammars, context-free grammars, finite state grammars; Bachus-Naur form; lexical analysis-LEX: compiler generators-YACC; recursive descent parsing techniques.

6.851R Electronics and Instrumentation S1 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to electronics. Provides a basis of circuit theory and elementary electronics and then treats filters, frequency response, general amplifier characteristics, operational amplifiers and their use in instrumentation, power supplies, analog computers and their use in modelling non-electrical systems. Included is a project illustrating the application of electrical engineering to other disciplines.

6.852R Electrical Machinery and Supply S2 L1T2

Prerequisite: 6.851R.

A user-oriented introduction to the usage of electrical power in industry, covering the characteristics and selection of electrical machinery, its interface with the prime power supply, protection, electrical safety and compliance with Australian standards. Included in the subject is a project illustrating the application of electrical engineering to various aspects of industry.

6.854 Electrical Power Engineering S2 L1T4

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 two 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 S1 L2T1

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. Sensors and transducers. Digital logic using integrated circuits. Noise and noise immunity. Techniques for A/D and D/A conversion.

6.902 Industrial Experience

A minimum of three years of appropriate industrial experience must be obtained concurrently with attendance in Course 3650. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

6.903 Industrial Training

Students enrolled in courses 3640, 3725 and 3720 must complete a minimum of 60 days' industrial training. Students are required to submit to the School evidence from their employers confirming completion of the prescribed training. Experience claimed as an industrial elective would cover requirements for this subject.

6.911 Thesis

This is done in the last two sessions of the BE degree course. For full-time students, two hours per week in the first session, and three days per week in the second session are devoted to directed laboratory and research work on an approved subject under guidance of

members of the lecturing staff. Part-time students may need to attend the University full-time in their final session or attend for one further part-time session, if facilities are not available for the thesis to be done at work. Generally, the thesis involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar, and a written thesis must be submitted on each project by the penultimate Monday in November or June.

6.921 Project

The project is done in the final stages of the BSc(Eng) course. It involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar and submit a written report. The project should represent the equivalent of a minimum 100 hours of directed laboratory work. If facilities are not available for this to be done largely at work, students may need to attend the University full-time in final session, or attend for one further part-time session.

6.931 Industrial Elective

6.932 Industrial Elective

6.933 Industrial Elective

Prerequisites: Students must be in at least the third stage of part-time BE degree course and be in full-time approved employment.

Each elective represents one year of appropriate quality concurrent industrial experience for students in approved full-time employment. Students must submit evidence to the satisfaction of the Head of School; this could include a critical analysis and reporting of aspects of the student's experience and may require some attendance at the University for reporting sessions and the submission of a written report.

A maximum of three such electives can be taken and they may be substituted for certain subjects in course 3640 requirements. An Industrial Elective cannot be claimed for work submitted for credit as 6.911 Thesis. Details of the procedure for registering and the requirements to be met can be obtained from the School of Electrical Engineering and Computer Science.

Civil Engineering

8.001 Industrial Training

Prerequisite: 8.670. Requirement for the Bachelor of Engineering Degree.

Students are required to complete a minimum of 60 working days of approved industrial training and submit a report on this training before the fourth week of Session 1.

8.011 Special Projects — SS T3

Equal to one Technical Elective.

A minor thesis or research project on any approved topic.

8.012 Elements of Architecture — SS L2T1

Introduction concerning the influence of structural technique in the past on architectural styles. Effect of modern structural engineering systems on architecture. Responsibilities of the structural engineer as a consultant.

8.013 Bridge Engineering — SS L1½T1½

Prerequisite: 8.1822.

An introductory subject in the design of road and railway bridges. Types of bridges, economic spans and proportions. Design loads and codes. Aspects of the design of steel, reinforced concrete, prestressed concrete, and composite bridges by empirical, elastic and limit state methods.

8.014 Computer Applications in Civil Engineering — SS L2T1

Prerequisites: 8.2733, 8.351 or 8.362, 8.360.

Advanced programming techniques such as the use of tapes, discs and plotter. Applications of advanced computational methods to structural analysis, geotechnology and flow problems.

8.015 Road Engineering — SS L2T1

Prerequisite: 8.671. Co-requisite: 8.2732.

Design of roads in urban and rural areas. Properties of asphalts and bitumens. Base course materials. Pavement design. Skid resistance. Performance evaluation.

8.017 Transportation Engineering — SS L2T1

History, development and characteristics of modes of transport. Fundamentals and evaluation of transport systems, performance and output. Interaction between land use and traffic demand.

8.018 Construction Engineering — SS L2T1

Prerequisites: 8.671, 8.312 or 8.301.

Advanced constructure methods and techniques with special reference to major civil engineering projects under construction in Australia.

8.019 Railway Engineering — SS L2T1

Track geometry. Traffic systems. Design of rail beds. Properties of ballast and track materials. Design project. Railway development. Maintenance planning.

8.020 Hydrology — SS L2T1

Prerequisite: 8.582.

Flood estimation with particular reference to design and flood forecasting. Outline of current practices and recent developments. Discussion of possible/likely implications of recent developments for the practising engineer.

8.021 Environmental Aspects of Civil Engineering — SS L2T1

Prerequisite: 8.301 or 8.312.

Examination of the professional issues arising from the environmental impact of civil engineering planning, design and construction. Methodologies for environmental impact evaluation and general project evaluation. Environmental legislation, institutional procedures and decision-making processes. Case studies and project work in the above context.

8.023 Hydrodynamics — SS L2T1

Prerequisite: 8.572.

Equations of continuity, motion and vorticity; stream function and velocity potential function; Laplace equation; standard flow patterns; practical applications.

8.024 Foundation and Dam Engineering — SS L2T1

Prerequisite: 8.2732.

Foundations of structures and dams. Problems. Alternative foundation types. Treatment of foundation soils. Piling and grouting. Consolidation and drainage. Allowable settlement of structures. Settlement calculations. Design of earth and rock fill dams. Stability during construction and drawdown. Case studies of dam failures. Piping. Erosion.

8.025 Structural Failures — SS L2T1

Prerequisites: 8.174, 8.1822.

Case studies of significant structural failures and distress during concept, construction, design and use. Modes, causes, consequences, responsibilities, corrective procedures.

8.026 Systems Methods in Civil Engineering — SS L2T1

Prerequisite: 8.672.

The development of models for the definition, design, and control of engineering problems in construction project management. Influence of decision level on systems model formulation. Case study approach coupled with field investigations and group projects. All students are required to visit a nominated field site as an integral part of the subject.

8.027 New Materials 1 — SS L2T1

Prerequisite: 8.2722.

History and development of polymers. Structure of polymetric materials. Properties and applications of thermoplastics and thermosets. Reinforced plastics; Fabrication. Structural analysis and application to the design of FRP structures. Building adhesives, epoxies and ceramic wall tile fixing. Modified concrete, polymer concrete and glass fibre reinforced cement.

8.028 New Materials 2 — SS L2T1

Prerequisites: 8.1822, 8.2722.

Theory and application of fibre reinforcements — glass and steel fibre reinforced cements, mortars and concrete composites. Shrinkage compensated and expansive cement — applications. Utilization of blast-furnace slag. Special aggregates and high strength concretes. New techniques of testing and removing concrete and reinforced concrete structures.

8.029 Continuum Mechanics — SS L2T1

Prerequisite: 8.172.

Concept of continua, mathematical foundations, analysis of deformation, strain and stress, fundamental laws of continuum mechanics, constitutive equations, mechanical properties of solids and fluids, simple problems in elasticity.

8.030 Construction Management — SS L2T1

Co-requisite: 8.672.

Civil Engineering Construction organization, management and control.

8.031 Construction Project Finance — SS L2T1

Co-requisite: 8.672.

Civil Engineering construction project feasibility, financial management, cash flow, cost control, insurance and company finance.

8.032 Construction Law — SS L2T1

Prerequisite: 8.672.

The legal system, court procedures, sources of legal information, areas of liability for the professional engineer. The basic rules and concepts of the laws of tort and contract, with particular reference to their application to construction work. Case studies of significant litigation involving construction engineers and their actions. Arbitration as an alternative means of settling disputes.

8.033 Industrial Law and Arbitration — SS L2T1

Prerequisites: 8.672, 8.032.

Introduction to industrial law, including reference to Commonwealth and State statutory provisions dealing with conciliation and arbitration. State and Commonwealth awards. Industrial disputes. Employers' association. Trade unions. Introduction to real property and local government law.

8.034 Engineering Economy — SS L2T1

Prerequisite: 8.672.

Economic evaluation of civil engineering projects, including benefit-cost analysis and rate of return analysis.

8.038 Special Topics in Reinforced Concrete Design — SS L2T1

Prerequisite: 8.1822.

General design process; limit states concepts. Design for bending and compression; ductility. Biaxial bending. Shear and torsion. Serviceability design.

8.039 Computer Programming — SS L2T1

Excluded: 8.360.

Introduction to the use of higher level programming languages such as PASCAL and FORTRAN and the principles of program design. Computing techniques. Development of software and its applications.

8.040 Advanced Engineering Geology — SS L2T1

Introduction to structural geology rock types. Macro and Micro characteristics base studies. Fabric analysis. Defects in rocks. Representation of defects. Schmidt diagrams. Laboratory studies.

8.041 Geological Engineering — SS L2T1

Prerequisite: 8.2721.

Site investigations. Techniques. Mechanical properties of rocks. Laboratory testing of rocks. Schmidt projections applied to slope stability. Flow of water in rock masses. Underground and open excavations. Rock blasting.

8.042 Water Resources — SS L2T1

Resource systems approach to the problem of matching, by means of engineering works, the supply of water and the demand for water. The design and operation of water resource systems.

8.043 Public Health Engineering — SS L2T1

Prerequisite: 8.581.

Water collection, transmission and distribution systems. Sewage collection and effluent disposal. Design of sewage treatment and water treatment processes. Principles of advanced wastewater treatment. Swimming pools. Refuse collection and disposal.

8.047 History of Civil Engineering — SS L2T1

A study of the theoretical, practical and sociological aspects of the development of civil engineering, including its relationship to other disciplines.

8.051 Design Project — Materials

Final year design in the field of civil engineering materials.

8.052 Design Project — Structures

Prerequisite: 8.191 (students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject).

Final year design project in the field of structural engineering.

8.053 Design Project — Water

Prerequisite: 8.573 or 8.582 or 8.581.

Final year design project in the field of hydraulics and water resources.

8.054 Design Project — Engineering Construction

Prerequisite: 8.672.

Final year design project in the field of engineering construction and management.

8.055 Applied Structural Analysis — SS L2T1

Prerequisite: 8.191 (students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject).

Practical application of methods of structural analysis both for a small design office (with programmable calculator) and a design office of moderate or large size (with mini-computer, terminals and commercial programs.)

8.056 Practical Structural Design — SS L2T1

Prerequisite: 8.191 (students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject).

Choice of structural system, approximate methods of analysis, preliminary proportioning of members. Checks on design calculations and computer output. Domestic structures; home-unit building design; steel industrial buildings; design of stairs and lift shafts; design of floor systems.

8.057 Special Topics in Prestressed Concrete — SS L2T1

Prerequisite: 8.1821.

Historical development, methods of prestressing, general flexural theory, calculation of losses, anchorage zone design, partial prestressing.

8.058 Special Topics in Steel Design — SS L2T1

Prerequisites: 8.174, 8.1821.

Plastic analysis and design of steel members and frames. Elastic-plastic material behaviour, moment-rotation relations. Lower bound and upper bound theorems. Plastic design steel structures.

8.059 Structural Vibrations — SS L2T1

Prerequisite: 8.174.

Importance of structural dynamics in civil engineering; earthquake effects and design requirements in buildings and other structures; wind loads on structures. Review of basic methods in dynamic analysis, with structural applications.

8.060 Numerical Methods in Geotechnology — SS L2T1

Prerequisite: 8.2732, 8.2733.

Introduction to finite element methods; application of finite element and finite difference techniques to various soil mechanics and rock mechanics problems such as stability analysis of foundation, retaining walls, tunnel openings; prediction of settlement of footing, piles and raft foundations; seepage and consolidation analysis.

8.062 Construction Camp

Prerequisite: 8.672. Co-requisite: 8.030.

A *one week field camp* involving several of the following: falsework systems and field productivity measurements; optimization of earthmoving equipment performance; concrete pumping systems; pile driving practice and the measurement of performance parameters; bridge erection techniques; rock drilling and blasting design and management; formwork design and erection and concrete pressure measurements; operation of earthmoving plant and demonstration of plant capabilities; noise measurements on construction sites; prestressing calculations and measurements on a full scale beam; crane capacity and productivity measurements; dewatering systems and measurement of well point performance; site investigation; compaction.

8.063 River and Coastal Engineering — S2 L2T1

Prerequisite: 8.573.

Sediment transport in channels and rivers. Coastal processes, wave characteristics and longshore transport. Design and use of hydraulic models.

8.081 Probability and Statistics for Civil Engineers — SS L2T1

Prerequisite: 8.351 or 10.381.

Tests of hypotheses. Analysis of variance and co-variance. Stochastic processes; queues (single and multiple channels), Markov chains, simulation. Bayesian decision. Applications to structural, geotechnical, and water problems.

8.082 Numerical Methods for Civil Engineers — SS L2T1

Prerequisite: 8.362.

Introduction to finite element method, application of FEM to structural, geotechnical and water engineering. Numerical techniques for the solution of eigenvalue problems. Optimization.

8.1110 Civil Engineering Practice — S2 L2T1

Introduction to the structure, nature and scope of civil engineering work and the problems resolved by practitioners. Branches of engineering; organization of the profession. Structure and nature of project work; demands on engineers at various phases. Analysis of the facilities provision system: its components and their organization; methodologies employed by engineers in their work. Communication methods and skills. Students are required: to become involved in one or more major ongoing projects; to prepare a major report on its structure and the roles and duties of the parties involved.

8.1120 Computing — S1 L1½T1½

Introduction to programming and the development of skills in the use of computers in problem solving. Development of effective and correct algorithms and data structures. Introduction to higher-level languages and the use of Pascal for program design and implementation.

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.

8.1140 Statics — S1 L1T2

Co-requisite: 10.001.

Two-dimensional concurrent and non-concurrent force systems. Equilibrium of particles and rigid bodies. Dry friction. Distributed forces: centre of gravity and centroid. Internal forces in structural members: shear and bending moment diagrams. Analysis of structures: trusses, frames and machines. Determinacy and constraints. Forces in cables. Three-dimensional statics: concurrent and non-concurrent force systems.

8.1210 Engineering Construction 1 — S1 L1T1

Identification of the basic processes that comprise construction activity. Detailed technological analysis of plant, processes and techniques involved in engineering construction activities including earthmoving, rock excavation and placement, concreting etc. Introduction to construction site organization and control. Preparation of a major report based on field observations.

8.1410 Dynamics and Vibration — S2 L2T1

Prerequisite: 8.1140.

Dynamics of particles. Laws governing conservation of energy and momentum. Derivation and solution of equations of motion for simple spring-mass systems responding to forces of simple form. Applications to civil engineering problems.

8.1610 Fluid Mechanics — S2 L1T1

Co-requisite: 10.001, 8.1140.

Fluid properties. Statics: fluid pressure, forces on surfaces, buoyant force, stability of floating bodies. Dynamics: kinematics, mass conservation, energy equation for an ideal fluid.

8.172 Mechanics of Solids 2 — SS L2T2

Prerequisite: 8.171.

Structural statics. Bending moments, shear force and torsion. Stresses due to shear force in solid and thin-walled sections, shear centre. Torsion of circular, non-circular and thin-walled sections. Principal stresses and strains; yield criteria. Combined stresses. Concepts of instability.

8.173 Structural Analysis 1 — SS L2T1

Prerequisite: 8.172.

The analysis of pin-jointed trusses. The principle of work applied to trusses; forces in, and deformation of, statically determinate trusses, statically indeterminate trusses (force method), displacement method of analysis; variational theorems; non-linear analysis.

8.174 Structural Analysis 2 — SS L2T1

Prerequisite: 8.173.

Force and displacement transformations. Rigid jointed frames and their components; the principle of work applied to frames; forces in, and deformation of, statically determinate frames; force and displacement methods of analysis; moment distribution, moving loads.

8.1811 Structural Design 1A — SS L2T1

Prerequisite: 8.170, 8.171. Co-requisite: 8.172.

Introduction to design concepts, structural safety, strength and serviceability. Characteristics of structural materials, structural members and structural forms. Loads on structures. Design of tension members. Behaviour and design of statically determinate laterally supported steel and timber beams; behaviour from basic principles at both service loads and overloads. Simple bolted and welded connections. Design of compression members in steel, timber and reinforced concrete. Design of simple steel trusses.

8.1812 Structural Design 1B — SS L2T1

Prerequisites: 8.172, 8.1811.

Behaviour, analysis and design of reinforced concrete beams from first cracking up to the ultimate moment capacity. Ultimate Strength Design or singly and doubly reinforced beams. T-beams, and one-way slabs from first principles. Design for shear; the truss analogy. Modular Ratio Theory and the service load behaviour of beams. Short-term and long-term deflections. Cracking and crack control. Bond and anchorage.

8.1821 Structural Design 2A — SS L2T1

Prerequisite: 8.1812.

Structural Loadings: dead, live and wind loading. Design of wind-resisting systems. Reinforced concrete beam-columns; strength interaction curves, treatment of slenderness effects and design procedures. Design and detailing of reinforced concrete continuous beams and frames and stairways. Behaviour and design of statically determinate prestressed concrete beams: pretensioning, post-tensioning, pros and cons, elastic stress calculations, moment and shear capacity, losses of prestress, and end block design.

8.1822 Structural Design 2B — SS L2T1

Prerequisite: 8.1812.

Behaviour and design of laterally unsupported steel beams and plate girders; lateral buckling and local buckling of flange and web. Design of bolted moment connections; bolting procedures, combined internal actions, standard details. Design of eccentrically loaded fillet weld connections. Steel compression members with elastic end restraint. Steel beam-columns. Plastic analysis and design of continuous steel beams. Composite steel-concrete construction; beam design. Design of timber beams, compression and tension members and connections.

8.191 Structural Engineering — SS L1½T1½

Prerequisites: 8.174 (See Note), 8.1821, 8.1822 (See Note).

Note: Students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject.

1. Variational theorems applied to rigid frames; non-linear analysis; stability analysis of framed structures. Plastic analysis of steel structures. Brief treatment of finite element methods, cable structures, arches plates and shells. **2.** Reinforced concrete two-way slabs. Flat slabs; static moment, simplified equivalent frame method for determination of design moments; punching shear. Plastic design of steel portal frames. Introduction to design of reinforced concrete retaining walls, and spread and strip footings.

8.2721 Civil Engineering Materials 1 — SS L2T2

Prerequisite: 8.271.

Minerals, texture and fabric in rocks. Engineering significance. Classification of rock types. Surface processes, geological structures. Geological maps and projections. Soil formation and mineralogy. Clay minerals. Classification of soils. Basic soil properties. Cements, chemistry and major constituents, hydration products, effects on concrete properties. Aggregate materials for use in Portland cement concretes and their influence on concrete properties; principal test.

8.2722 Civil Engineering Materials 2 — SS L2T2

Prerequisite: 8.271.

Mechanical behaviour of materials. Response to loads. Yielding criteria and fracture. Effects of stress state, strain rate and temperature. Principles of fracture mechanics. Behaviour of typical materials. Metals engineering. Structure and properties of metals and alloys. Hot and cold working. Thermal treatments. Welding. Common processes for welding, metallurgical aspects and weldability. Occurrance of flows, testing of weldments, significance for engineers.

8.2731 Geotechnical Engineering 1 — SS L1T1

Prerequisite: 8.2721.

Basic soil properties and classification for engineering purposes; soil water, soil suction and the effective stress law; steady flow of water through soils; consolidation of soil masses; failure and shear strength of soils; stress strain characteristics of soils.

8.2732 Geotechnical Engineering 2 — SS L1T1

Prerequisite: 8.2731.

Site investigation principles and practice; compaction and mechanical stabilization for soil masses; lateral earth pressures and retaining wall analysis; bearing capacity of isolated foundations; settlement analysis of isolated foundations; slope stability analysis for natural and man made slopes.

8.2733 Rock Engineering — SS L1T1

Engineering properties of rock material and rock mass, elastic, plastic, creep and fracture behaviour of rock, continuum mechanics approach to rock behaviour. Application of rock mechanics principles to engineering problems. Case studies.

8.2741 Concrete Technology — SS L2T2

Prerequisite: 8.2721.

Properties of concrete. Structure and composition. Rheological models of fresh concrete. Mix design. Multi-phase theory of elastic behaviour. Bond with reinforcement. Creep and drying shrinkage. Durability, physical and chemical deterioration, permeability. Non-destructive testing. Special concretes and special techniques.

8.2742 Metals Engineering — SS L2

Prerequisite: 8.2722.

Application of metals in civil engineering structures; steels, aluminium alloys and other common metals. Design for avoidance of service failures. Corrosion, basic principles, causes and control. Fatigue and brittle fracture; relationships between material toughness, design stress, flaw size, stress concentrations and service conditions; effects of temperature, loading rate, restraint. Tradition and applied fracture mechanics approaches to fracture safe design. Welding, significance for the designer, quality requirements and control.

8.311 Systems Engineering 1 — SS L1T1

Prerequisites: 5.0102, 8.670, 10.001.

The systems approach to problem formulation and analysis by introduction to elements of systems theory and case studies relevant to engineering and project design.

8.312 Systems Engineering 2 — SS L1T1

Prerequisites: 8.311, 8.360. Co-requisite: 10.381.

Formulation of engineering resource problems for numerical analysis and decision-making, and study of a selected set of numerical evaluation techniques.

8.362 Engineering Computations — SS L2T1

Prerequisites: 10.022, 8.360.

Numerical techniques for the solution of engineering problems — Solution of non-linear equations and linear simultaneous equations. Finite differences, numerical differentiation and integration, interpolation and extrapolation. Solution of ordinary and partial differential equations. Applications to buckling and vibration problems, deflection of plates and beams, heat conduction, flow of fluids and wave propagation.

8.400 Transport Engineering 1 — SS L2T1

Discrete flow phenomena, definitive concepts — headway and counting distributons, speed distributions, service time distributions. Queueing and delay. Saturation Flow — programmed and non-programmed flow. Traffic networks: shortest path, maximum flow. Road traffic applications: highway and intersection capacity, travel time and delay; traffic control devices, lanes, medians, turn pockets, traffic signals, coordination.

8.401 Transport Engineering 2 — SS L2T1

The land use/transport system — urban, regional and local systems. Definitive concepts and ideas — land use potential, transport impedance accessibility, traffic generation. Equations of state of a land use/transport system, feedback equilibrium. Land use transport planning process; land use, traffic generation, distribution, assignment and evaluation models. Strategic planning issues; optimization, sensitivity analysis, constraints and resources. Operational planning.

8.571 Hydraulics 1 — SS L1½T1½

Prerequisites: 5.0201, 10.001.

Fluid properties. Hydrostatics, stability of floating bodies. Fluid acceleration, flow patterns. Continuity, energy and momentum equations.

8.572 Hydraulics 2 — SS L1½T1½

Prerequisite: 8.571.

Dimensional analysis. Hydraulic model theory, scale effect. Fluid turbulence, velocity distribution, surface resistance in flow past plane boundaries and in pipes and channels. Pipe flow, pipe networks. Elements of hydrodynamics.

8.573 Hydraulics 3 — SS L1½T1½

Prerequisite: 8.572.

Open-channel flow, steady non-uniform flow, hydraulic jump. Flow measurement. Unsteady flow in pipes, Hydraulic machinery, radial and axial flow pumps, characteristic curves, cavitation.

8.581 Water Resources 1 — SS L1½T;½

A prior knowledge of elementary hydraulics is assumed.

Water pollution and water quality criteria. Sources of supply, collection, transmission and distribution. Quality requirements and treatment processes. Waste water collection; reticulation and pumping stations; effluent quality requirements; outline of treatment processes. Outfall structures and ocean disposal. Water reclamation.

8.582 Water Resources 2 — SS L1½T1½

A prior knowledge of elementary hydraulics is assumed.

The hydrologic cycle, water and energy balances, climatology, atmospheric moisture, precipitation, runoff cycle, infiltration, stream gauging, hydrograph analysis, storm runoff and loss rates, design storms, flood estimation, yield and storage determination.

8.583 Water Resources 3 — SS L1T2

Prerequisites: 8.572, 8.582.

Hydraulics of groundwater systems, application to regional problems. Water resources planning, systems approach, applied aspects of water engineering.

8.6120 Civil Engineering for Electrical Engineers — SS L2T2

Includes an introduction to the various branches of civil engineering, the nature and organization of the profession. Relationship between clients and design consultants. The historical development of Civil Engineering. Theory of beams and trusses, resultant forces, structural action, stress and strain. Relation between load, shear force and bending movements, geometric properties of sections, deflection of beams. Properties of materials used in structures; various steels, concrete (plain, reinforced and prestressed), aluminium and timber. Brittle fracture. Introduction to buckling. Engineering failures. Introduction to design of transmission lines and towers.

8.6140 Engineering for Surveyors 1 — SS L1½T1½

Aspects of Hydraulics: fluid properties, hydrostatics, motion of fluids, continuity, energy and momentum aspects, closed conduit flow and open channel flow. *Aspects of Hydrology:* Scope and applications. Hydrologic measurements, rainfall analysis, storm rainfall-runoff relations, flood estimation. Urban drainage design.

8.6150 Engineering for Surveyors 2 — SS L3

Municipal Engineering. Soil Mechanics: Soil forming processes; pedological classification; engineering classification of soils; pavement design based on engineering classification; effective stress concept for saturated and unsaturated soils, shear strength, flow of water through soils, consolidation; slope stability and earth pressures. *Public Utilities:* Relationship between urban development and each of water supply, wastewater and stormwater drainage, transport.

8.671 Engineering Construction — SS L2T1

Prerequisite: 8.670.

Role of professional construction engineer. Project breakdown into construction activities and operations. Engineering construction characteristics of equipment, materials and methods with emphasis on earth-moving, rockworks, compressed air and concrete placement and formwork.

8.672 Planning and Management 1 — SS L2T2

Prerequisite: 8.671.

Project definition, documents, estimating, planning and scheduling models. Project finance and cost control methods. Field project management and reporting systems.

8.673 Planning and Management 2 — SS L1T2

Prerequisite: 8.672.

Fundamentals of Engineering Economy developed within a microeconomic systems framework for application by the following decision-makers: plant engineer, contractor, developer, local government engineer, and State/National engineering project managers.

8.674 Planning and Management 3 — SS L1T2

Prerequisite: 8.672.

Project implementation, organization and control, field management techniques, industrial relations, field documentation and information flow, field change orders, risks, and delays, legal aspects, the relationship and duties between professional agents involved in projects.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Faculty of Applied Science Handbook.

8.6110 Structures — S1 L1T2

Theory of Structures: Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strains. Relationship between load, shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment, shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

8.6130 Properties of Materials — F L1T1

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact. Deterioration of engineering materials. Rheological classification of materials.

Mathematics

10.001 Mathematics 1 — F L4T2

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
or	
10.021B.	

Excluded: 10.011, 10.021B, 10.021C.

*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).

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.011 Higher Mathematics 1 — F L4T2

Prerequisite:

	HSC Exam Percentile Range Required
3 unit Mathematics	*71-100*
or	
4 unit Mathematics	*11-100*

Excluded: 10.001, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

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 or Applied Mathematics 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.

10.033 Electrical Engineering Mathematics 3 — F L1½T½

Prerequisites: 10.111A, 10.1113, 10.1114, 10.2111, 10.2112.

Numerical Analysis: Interpolation, roots of equations, approximation of definite integrals. Difference equations, Z-transform. Approximate solution of ordinary differential equations. Approximate solution of matrix problems, matrix inversion, eigenvalue and eigenvector problems.

Partial Differential Equations: Characteristics. Continuous and discrete Fourier transforms. Autocorrelation. Spectral density. Laplace transform. Potential theory. Numerical solution of parabolic, elliptic and hyperbolic partial differential equations.

Optimization.

10.111A Pure Mathematics 2 — Linear Algebra — F L1½T1

Prerequisite: 10.001 or 10.011. Excluded: 10.121A.

Vector spaces, linear transformations and matrices, change of basis. Eigenvalues and eigenvectors, generalized eigenvectors. Functions of matrices. Linear systems of differential equations including the use of Laplace transform. Inner products, orthogonalization, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1111 Pure Mathematics 3 — Group Theory — S1 L1½T½

Prerequisite: 10.001. Co-requisites: 10.111A, 10.1113, 10.1114, 10.2111, 10.2112. Excluded: 10.121A.

Mathematical systems, groups, determination of small groups, homomorphisms and normal subgroups.

10.1112 Pure Mathematics 3 — Geometry — S2 L1½T½

Prerequisite: 10.001. Co-requisite: 10.1111. Excluded: 10.121C, 10.1424.

Elementary concepts of Euclidean, affine and projective geometries.

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.

10.1114 Pure Mathematics 2 — Complex Analysis — S1 or S2 L1½T1

Prerequisite: 10.001 or 10.011. Excluded: 10.1214.

Analytic functions, Taylor and Laurent series, integrals. Cauchy's Theorem, residues, evaluation of certain real integrals.

10.1115 Pure Mathematics 2 — Finite Mathematics A — S1 L1½T½

Prerequisite: 10.001.

Positional number systems, floating-point arithmetic, rational arithmetic, congruences, Euclid's algorithm, continued fractions, Chinese remainder theorem, Fermat's theorem, applications to computer arithmetic. Polynomial arithmetic, division algorithm, factorization, interpolation, finite field. Codes, error-correcting codes, public-key cryptography.

10.1116 Pure Mathematics 2 — Finite Mathematics B — S2 L1½T½

Prerequisite: 10.1115 (or any other Year 2 Mathematics half-unit).

Introduction to combinatorial computing, recurrence relations, examples of divide and conquer strategies, backtrack and branch and bound algorithms. Finite Fourier transforms, roots of unity, convolutions, applications to fast multiplication and the analysis of pseudo-random numbers. Boolean algebra, switching circuits.

10.121A Higher Pure Mathematics 2 — Algebra **F L2T½**

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.111A, 10.1111.

Linear Algebra: vector spaces, commutative rings, polynomials, modules, linear transformations, eigenvectors, invariant subspaces, canonical forms, linear functions, bilinear and multi-linear algebra. Group Theory: subgroups, quotient groups, isomorphisms,Lagrange's theorem, Sylow's theorem.

10.1214 Higher Pure Mathematics 2 — Complex Analysis **S2 L2T½**

Prerequisite: 10.1213. Excluded: 10.1114.

As for 10.1114 Pure Mathematics 2 — Complex Analysis, but in greater depth.

10.2111 Applied Mathematics 2 — Vector Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011. Excluded: 10.2211, 4.813.

Vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics 2 — Mathematical Methods for Differential Equations **S1 or S2 L1½T1**

Prerequisites: 10.001 or 10.011. Excluded: 10.2212, 4.813.

Series solution or ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series, Bessel functions.

10.2113 Applied Mathematics 2 — Introduction to Linear Programming **S1 or S2 L1½T½**

Prerequisite: 10.001. Excluded: 10.2213.

Mathematical expression of practical optimization problems. Calculus methods for simple problems. Feasible regions and graphical methods.

Linear programming: the standard problem, basic solutions, fundamental theorem, simplex tableau, initial solution, unbounded and multiple solutions, degeneracy, duality; the dual simplex method, post optimal analysis.

10.2115 Applied Mathematics 2 — Discrete-Time Systems **S2 L1½T½**

Prerequisite: 10.001. Excluded: 10.2215.

Introduction to discrete-time dynamic systems. Difference equations: existence and uniqueness of solutions, general solution of linear equations. Linear systems: dynamics, stability, and oscillations, z-transforms, state-space methods. Nonlinear systems: equilibrium points, limit cycles.

Applications selected from problems of importance in engineering, biological, social, management, and economic systems.

10.2211 Higher Applied Mathematics 2 — Vector Analysis **S1 L1½T1**

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.2111.

As for 10.2111 but in greater depth.

10.2212 Higher Applied Mathematics 2 — Mathematical Methods for Differential Equations **S2 L1½T1**

Prerequisite: 10.2211. Excluded: 10.2112.

As for 10.2112 but in greater depth.

10.2213 Higher Applied Mathematics 2 — Introduction to Linear Programming **S1 L1½T½**

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.2113.

Mathematical expression of practical optimization problems. Calculus methods for simple problems. Feasible regions.

Linear programming: the standard problem, basic solutions, fundamental theorem, simplex tableau, initial solution, unbounded and multiple solutions, degeneracy, revised simplex method, duality, dual simplex method, post optimal analysis.

10.2215 Higher Applied Mathematics 2 — Discrete-Time Systems **S2 L1½T½**

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.2115.

As for 10.2115, but in greater depth and with additional material on positive linear systems and Markov chains.

10.311A Theory of Statistics 2 — Probability and Random Variables **S1 L3T1**

Prerequisite: 10.001 or 10.011 or 10.021C (CR). Excluded: 10.321A, 10.301, 10.331, 45.101.

Probability, random variables, standard discrete and continuous distributions, multivariate distributions, transformations, random sampling, sampling distributions, limit theorems.

10.311B Theory of Statistics 2 — Basic Inference **S2 L3T1**

Prerequisite: 10.311A. Excluded: 10.321B, 10.301, 10.331, 45.101.

Point estimation: general theory, estimation by moments, maximum likelihood, interval estimation with general theory and application, hypothesis testing using Neyman-Pearson Theory, linear regression and prediction, analysis of variance.

10.3111 Theory of Statistics 2 — Statistical Computing and Simulation **S1 L1½T½**

Prerequisite: 10.001 or 10.011 or 10.021C(CR). Co-requisite: 10.311A.

Introduction to APL, random variables, univariate transformation, simulation of random variables, APL programming, integer value random variables, random walks — theory and simulation, introduction to Markov chains.

10.3112 Theory of Statistics 2 — Nonparametric Statistical Inference S2 L1½T½

Prerequsite: 10.311A. Co-requisite: 10.311B.

Order statistics, exact and approximate distributions, multinomial distributions, goodness of fit, contingency tables, one-sample and two-sample estimation and inference problems.

10.321A Higher Theory of Statistics 2 — Probability and Random Variables S1 L3T1

Prerequisite: 10.001 or 10.011. Excluded: 10.311A, 10.301, 10.331, 45.101.

As for 10.311A but in greater depth.

10.321B Higher Theory of Statistics 2 — Basic Inference S2 L3T1

Prerequisite: 10.321A. Excluded: 10.311B, 10.301, 10.331, 45.101.

As for 10.311B but in greater depth.

10.3211 Higher Theory of Statistics 2 — Statistical Computing and Simulation S1 L1½T½

Prerequisite: 10.001. Co-requisite: 10.321A.

As for 10.3111 but in greater depth.

10.3212 Higher Theory of Statistics 2 — Nonparametric Statistical Inference S2 L1½T½

Prerequisite: 10.321A. Co-requisite: 10.321B.

As for 10.3112 but in greater depth.

10.331 Statistics SS F L1½T½

Prerequisite: 10.001 or 10.021C (CR). Excluded: 10.311A, 10.311B, 10.321A, 10.321B, 10.301, 45.101.

An introduction to the theory of probability, with finite, discrete and continuous sample spaces. The standard elementary univariate distributions: binomial, Poisson and normal; an introduction to multivariate distributions. Standard sampling distributions, including those of x^2, t and F. Estimation by moments and maximum likelihood (including sampling variance formulae, and regression); confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to experimental design; fixed, random and mixed models, involving multiple comparisons and estimation of variance components.

10.341 Statistics SU F L1½T½

Prerequisite: 10.001 or 10.011.

Introduction to probability theory, random variables and distribution functions, sampling distributions, including those of t, x^2 and F. Estimation procedures, including confidence interval estimation with an emphasis on Least Squares and surveying problems, and computer based exercises.

10.351 Statistics SM F L1T1

Prerequisite: 10.001 or 10.011.

For students in Aeronautical, Industrial and Mechanical Engineering and Naval Architecture.

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

10.361 Statistics SE F L1½T½

Prerequisite: 10.001 or 10.011

For students in the School of Electrical Engineering.

Introduction to probability theory, random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of x^2 and t. Estimation by moments and maximum likelihood; confidence interval estimation. The Standard tests of significance based on the above distribution with a discussion of power where appropriate.

An introduction to linear regression, auto-regression. Probability limit, law of large numbers and central limit theorem. Multivariate normal distribution. Stochastic processes in discrete and continuous time: Poisson and Gaussian processes.

10.381 Statistics SC S1 or S2 L1T1

Introduction to probability. Random variables. Elementary distribution. Statistical inference. Point estimation. Confidence intervals.

10.4111 Theoretical Mechanics 2 — Introduction to Theoretical Mechanics S1 L1½T½

Prerequisites: 10.001, 1.001 or 5.006. Co-requisites: 10.2111, 10.2112, 10.1113. Excluded: 1.992, 1.002, 10.411B, 10.421B, 10.4211.

Revision of vectors, kinematics. Dynamics of particles including simple harmonic motion and projectiles. Systems of particles. Conservation principles. Work, energy and power. Rotating frames of reference and the motion of rotating bodies.

10.4112 Theoretical Mechanics 2 — Introduction to Hydrodynamics S2 L1½T½

Prerequisite: 10.001. Co-requisite: 10.4111 or 1.002. Excluded: 10.411A, 10.421A, 10.4212.

Equations of continuity and motion. Bernoulli's equation for an incompressible liquid. Kelvin's theorem. Some irrotational flow problems in one, two and three dimensions.

10.412A Theoretical Mechanics 3 — Dynamical and Physical Oceanography **F L1½T½**

Prerequisites: 10.2111 & 10.2112 or 10.031, 1.001. It is recommended that one of the following be taken concurrently: 10.4112 or 1.3533.

A brief review of the basic physical features of the oceans and the physical properties of sea water. Elementary hydrodynamics. An introductory discussion of turbulence. Geostrophy, dynamic heights and the inference of currents from hydrographic measurements. Ekman layers. Wind-driven ocean circulation, western boundary currents. Surface and internal waves, tides. Thermohaline processes: mixing, entrainment, double-diffusive phenomena, mixed layers and gravity currents.

10.412B Theoretical Mechanics 3 — Continuum Mechanics **F L1½T½**

Prerequisites: 10.2111, 10.2112, 10.111A, 10.1113, 10.1114. Co-requisites: 10.411A or 1.012 or 1.913. Excluded: 10.422B.

Cartesian tensors, stress and strain in continuous media. Equations of equilibrium and motion. Equations of elasticity. Bending and torsion of beams. Plane elasticity (if time available). Viscous flow of liquids (if time available).

10.4211 Higher Theoretical Mechanics 2 — Introduction to Theoretical Mechanics **S1 L1½T½**

Prerequisites: 10.011 or 10.001 (DN), 1.001 or 5.006. Co-requisites: 10.2211, 10.2212, 10.1113. Excluded: 1.992, 1.002, 10.411B, 10.421B, 10.4111.

As for 10.4111 but in greater depth.

10.4212 Higher Theoretical Mechanics 2 — Introduction to Hydrodynamics **S2 L1½T½**

Prerequisites: 10.011 or 10.001 (DN), 10.4211 or 1.002 (CR). Excluded: 10.421A, 10.411A, 10.4112.

As for 10.4112 but with additional topics chosen from aerofoil theory, water waves and sound waves.

Accountancy

14.001 Introduction to Accounting A **S1 L2**

Architecture: 2 credit points; compulsory for BBuild degree course students.

Prerequisite: Nil.

An introduction for non-commerce students to the nature, purpose and conceptual foundation of accounting. Information systems including accounting applications. Analysis and use of accounting reports.

14.002 Introduction to Accounting B **S2 L2**

Arcitecture: 2 credit points; compulsory for BBuild degree course students.

Prerequisite: 14.001.

An introduction for non-commerce students to managerial accounting. Long-range planning, budgeting and responsibility accounting; cost determination, cost control and relevant cost analyses.

Economics

Industrial Relations

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.

Health Administration

16.711 Quantitative Methods 1 **S1 L4**

Prerequisite: 16.540.

Sources of statistical data; errors and pitfalls in the use of statistics. Measures of central tendency, dispersion and skewness. Elementary treatment of probability. Introduction to statistical inference; estimation and hypothesis testing, elements of sampling and sample survey design. Correlation and regression. Index numbers. Time series analysis. Introduction to demography and vital statistics; measures of mortality, fertility and population replacement. Statistics of the Australian health care system including the measurement of morbidity and health service utilization, and statistics for quality assurance, planning and evaluation.

Industrial Engineering

Industrial Engineering is a Department within the School of Mechanical and Industrial Engineering.

18.003 Numerical Methods/ Industrial Experimentation — S1 L1T½ S2 L1½T½

Prerequisites: 5.072, 10.001, 10.022.

Numerical methods: numerical solution of systems of linear and non-linear equations. Numerical interpolation, differentiation and integration. *Industrial experimentation:* planning experiments. Common probability distribution. Experiments of comparison. Accelerated life testing. Analysis of variance. Correlation and regression.

18.004 Manufacturing Management — F L1T1

Prerequisites: 18.503, 18.603, 14.001, 14.002.

Production control: modes of manufacture; information flow in multi-stage production systems; classical production and inventory models and control techniques; Material Requirements Planning; Just-in-Time Production; Flexible Manufacturing Systems and their control. *Quality control:* sampling inspection, economic aspects, control charts, management of QC. *Project control:* critical path scheduling, PERT. Computers in manufacturing management: systems design.

18.020 Industrial Orientation — S2 L1

A series of lectures and discussions designed to prepare students for Industrial Training. *Topics include:* Forms and structure of private and public organizations; line and staff; authority and responsibility; company objectives; functions of staff departments, eg personnel, purchasing, quality control, industrial engineering, accounting; new forms of organization. Industrial legislation, industrial relations, safe practices. Employer expectations of the trainee engineer, requirements for the Industrial Training Report. Introduction to the specialist streams of Years 3 and 4.

18.091 Industrial Management — S1 LT5

Prerequisites: 10.2112, 10.361.

Engineering Economy: economic objectives of the firm. Economic measures 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:* The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation, critical path networks. *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.

18.224 Numerical Control of Machine Tools — S1 or S2 L2T1

Overview of numerical control systems; machine specification and selection; manual part programming; production and operator aspects including selection of operating conditions, work holding devices and tooling; introduction to computer assisted programming dealing with specific and generalized part programming.

18.303 Methods Engineering — F L1T1

Prerequisites: 5.072, 18.020.

Aims: Historical development, measurement of productivity. *Methods study:* motion economy, ergonomics, man-machine relationships. *Factory environment:* layout, conditions, safety. *Work measurement:* purposes, time study, fatigue, human work capacity, predetermined motion time systems, regression methods, work sampling. *Human factors:* motivation to work, job satisfaction, socio-technical systems, incentive plans. *Laboratory:* exercises in work measurement, workplace design, ergonomics.

18.403 Production Design and Technology — F L2T2

Prerequisites: 5.072, 5.422 or 5.411 and 8.259.

Basic metrology and tolerancing, introduction to plasticity theory and its application to theories for machining and forming, economics of production processes; interaction of machines and tools; principles of process selection; review of major processes, interaction of design, production quantity, materials and processes; value analysis.

18.404 Design for Production — F L1T1

Prerequisite: 18.413 or 5.123.

Product design, development and manufacture important in the manufacturing industry. Includes industrial design, patents law, product liability, product reliability, safety standards and regulations, process and operation planning, advanced production aids and jig and fixture design, advanced measuring inspection and gauging methods, quality control methods and systems.

18.413 Design for Industrial Engineers — S1 L1T1 S2 L1T2

Prerequisites: 5.122, 5.422.

Tooling design. Production aids. Fluid power systems. Introduction to fatigue in design.

Design analysis for manufacture; component design and drawing with individual and group projects of an interdisciplinary nature. (Some material taken with 5.123 Mechanical Engineering Design 3.)

18.503 Operations Research A — F L2T1

Prerequisites: 5.072, 10.022. Co-requisite: 18.803.

History and overview of operations research. Decision theory. Methodology; identification and formulation of the problem; construction of a model, obtaining solutions; testing the model and implementing the solution. Case study.

18.551 Operations Research F L2T1

Prerequisites: 18.603 or 18.121, 5.072 or 10.031 or 10.331.

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.

18.603 Management/Economics F L/T2

Prerequisites: 5.072, 18.020.

Introduction: objectives of a company, measures of performance, need for economic decisions. *Cost information:* sources of costs, fixed and variable, overheads, break-even analysis. *Engineering economics:* time value of money. Derivation and use of interest formulae. Evaluation of alternatives, annual and present equivalents. D.C.F. rate of return. The minimum acceptable rate of return. Capital budgeting. Replacement studies. Risk and uncertainty. *Management:* objectives of an organization; definition and functions of management. Development of management thought; interactions between organizations and their environment. The management functions of planning, organizing, leading and controlling; management and computers; the marketing concept. Industrial relations, trade union and arbitration structures in Australia.

18.803 Optimization S1 L2T1

Prerequisite: 10.022.

Optimization in one dimension. Conditions for optimality in n dimensions. *Linear programming:* problem formulation, solution by the simplex method, duality and post optimality analysis. The transportation algorithm. Dynamic programming. Unconstrained and linearly constrained non-linear programming. Geometric programming.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Faculty of Applied Science Handbook.

18.121 Production Management . F L2T1

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, queueing theory, inventory models, simulation.

18.131 Operations Research

Introduction to Operational Research: The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

Nuclear Engineering

23.051 Nuclear Power Technology F L2½T½

Atomic nuclei, radioactivity, neutron reactions, fissile and fertile materials, nuclear conversion and breeding cycles, plutonium. Criticality requirements, heat removal, control and safety of nuclear reactors. The thermal, hydraulic and structural aspects of gas and liquid cooled thermal reactors and liquid metal cooled fast breeder reactors. The status of fusion research and development. The technology, safety, economics and environmental impact of nuclear fuel cycles, from mining, through enrichment, fabrication and burnup to waste disposal. Comparative assessment of nuclear, fossil and alternative energy systems in local and global contexts.

Applied Geology

25.110 Earth Materials and Processes S1 L2T4

Constitution of the Earth. The Earth and the Solar System. The interior of the Earth: the crust and its chemical composition, gravity and isostasy. Minerals and rocks, economic mineral deposits. *Earth Processes.* The origin of igneous rocks; plutonism and volcanism. The geological cycle. Weathering processes, soil formation and landforms. The origin of sedimentary rocks; transportation, deposition, lithification. Arid, glacial and periglacial processes. Geological time. Metamorphism and metamorphic rocks. Structural geology, classification and origin of faults and folds. Quaternary stratigraphic sequences, neotectonics. *Field Work* of up to two days is a compulsory part of the subject.

25.120 Earth Environments and Dynamics — S2 L2T4

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science (multistrand)	*31-100*
and	
25.110.	

*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).

Earth Environments: Introductory palaeontology, including the evolution of life, invertebrates and vertebrates. Principles of stratigraphy. The stratigraphy of New South Wales: Broken Hill, Lachlan Orogen, New England Fold Belt and Sydney Basin. Introductory stratigraphy of Australia from the Precambrian to the Recent. The mineralogical study of rocks; techniques and significance of mineralogy. Structural geology; stereographic and statistical treatment of structural data. *Earth Dynamics:* The evolution of ocean basins; sea-floor spreading and sea-level changes. Climates of the past. Geophysical methods of exploration; seismology and earthquake prediction. Plate tectonics and continental drift. *Field Work* of up to four days is a compulsory part of the subject.

25.211 Earth Materials 1 — S1 L2T4

Prerequisite: 25.120.

Mineralogy: Principles of optical crystallography and the use of the polarizing microscope. Chemical and physical properties of rock forming minerals. Mineral identification. *Igneous Petrology:* Occurrence, classification and origin of igneous rocks. Fractional crystallization and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology relating to place tectonics. *Practical:* Macroscopic and microscopic examination of rock forming and ore minerals and igneous rocks in the field and the laboratory. *Field Work* of one day is a compulsory part of the subject.

25.212 Earth Environments 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 terrigenous clastic and carbonate/evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. *Palaeontology:* Morphology and stratigraphic distribution of invertebrates, including Foraminifera, Brachiopoda, Mollusca, Arthropoda, Protochordata and Echinodermata. Introductory palaeobotany. Palaeoecology. Biogeography. Trace fossils. Reef building organisms and the evolution of reefs. *Field Work* of up to five days is a compulsory part of the subject.

25.221 Earth Materials 2 — S2 L3T3

Prerequisite: 25.211.

Sedimentary Petrology: The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The chemically formed sedimentary rocks including the phosphates, zeolites, evaporites, ferruginous and silceous deposits. *Metamorphic Petrology:* Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies. *Structural Geology:* Origin, classification and description of structures in rocks. Techniques of stereographic projection of structural elements and analysis of simple fracture systems. Tectonics and tectonic analysis. *Field Work* of up to eight days is a compulsory part of the subject.

25.311 Earth Materials 3 — S1 L2T4

Prerequisite: 25.221.

Mineralogy: Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separation. Mineral characterization. *Geochemistry:* Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms. *Aqueous Geochemistry:* Redox potentials in nature. Oxidation/reduction and sediment formation. Solubilities, metal transport and ore deposition. The growth of minerals from solution and the development of mineral textures. Particular aqueous geochemical systems.

25.312 Earth Environments 2 — S1 L3T3

Prerequisite: 25.212 (note: it is desirable that students taking this unit have also taken 25.223).

Stratigraphy: Stratigraphic classification. Biological and physical methods of correlation. Introduction to radiogenic methods of age determination: 14C, K/Ar, Rb/Sr and fission track methods. Definition of international stratigraphic boundaries, stratotypes and reference points. Types of sedimentary basins and continental margins. The development of the Precambrian craton of Australia. The geological evolution of eastern Australia, particularly the late Palaeozoic and Mesozoic history of the Tasman Mobile Belt. Intracratonic basins of western and southern Australia and the effects of the dispersal of Gondwanaland. Geological evolution of the northern margin of the Australian plate, particularly the Mesozoic to Recent of Papua-New Guinea. *Palaeontology:* Theories of biological classification. Processes and theories of evolution. The origin and early history of life. Functional morphology. Practical application of palaeontology. *Field Mapping:* Geological mapping in a complicated geological terrain. Geological report writing and cartography. *Field Work* of up to eight days is a compulsory part of the subject.

25.314 Mineral and Energy Resources 1 — S1 L3T3

Prerequisite: 25.221.

Metallic Resources: Classification and origin of the ore deposits, geochemical processes, research methods. Orthomagmatic, hydrothermal, porphyry, volcanic-sedimentary, Mississippi Valley type, chromium, iron, manganese ores, residual and mechanical ores. Introduction to mineral exploration. Laboratory study of hand specimens, thin sections and polished sections of various ore types; study of selected mining areas representing various genetic types of ore. *Economic Mineralogy:* Nature of reflected light. Ore textures and their interpretation. Phase relations and paragenesis of ore minerals. Practical work in optical properties of ore minerals, hardness and reflectivity measurements: study of selected ores and ore minerals under the microscope including textural studies. *Field Work* of up to four days is a compulsory part of the subject.

25.321 Earth Materials 4 — S2 L3T3

Prerequisite: 25.221.

Clay Mineralogy: The structure and properties of the clay mineral groups including the kaolinites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. *Advanced Igneous Petrology:* Origin of silicate liquids. High pressure and low pressure fractionation. Liquids and fluids. Nature of the Upper Mantle. The use of trace elements and isotopes are petrogenetic indicators. Practical petrography and literature studies of igneous suites. Field study. *Advanced Metamorphic Petrology:* Facies series. Metamorphic reactions. Isograds. Mineral assemblages as geobarometers and geothermometers. Fluids in metamorphism. Fabric. Relationships of deformation and recrystallization. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic rocks. *Field Work* of up to six days is a compulsory part of the subject.

25.324 Mineral and Energy Resources 2 — S2 L3T3

Prerequisite: 25.212.

Non-metallic Resources: Geological factors critical to the occurrence of oil, natural gas, oil shale and coal. Geochemistry of hydrocarbons and formation fluids. Typical Australian and overseas occurrences of petroleum. Techniques of petroleum exploration, assessment and development of reserves. Introduction to coal petrology. Geological controls on the formation and distribution of coal. Occurrence and economic use of non-metallic products including phosphates, bauxites, beach sands and industrial minerals. *Sedimentary Basin Analysis:* Techniques of analysis and data presentation using information from outcrops, boreholes (including wireline logs) and seismic sections. Construction and interpretation of structural, isopachous and lithofacies maps. Seismic stratigraphy. Styles of sedimentation within and structuring of basins in tensional, compressive and strike-slip tectonic regimes. Basin evolution. *Field Work* of one day is a compulsory part of the subject.

25.325 Engineering and Environmental Geology — S2 L4T2

Environmental Geology: Hydrodynamics of pollutants and water quality principles. Domestic, industrial and radioactive waste disposal, deep well injections. Geological hazards and urban planning. Environmental impacts of dams, mineral exploration, mining and impact statement techniques. Water resources law and pollution. Land use conflicts. *Hydrogeology:* The hydrological cycle; confined and unconfined groundwater. Hydrological characteristics of rocks and their measurement. Pump tests. Aquifer boundaries. Exploration for groundwater development and monitoring of groundwater resources. Groundwater flow tests. Case studies from the Great Artesian Basin and the Murrumbidgee area. *Geomechanics:* Rock and soil masses and their engineering behaviour influence of composition and fabric. Discontinuities in rocks and soils and their analysis for engineering purposes. Mechanical properties and their measurement. Stress-strain theory. *Coastal Geology:* Properties of sedimentary populations. Sampling practices. Measurements of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters. The shoreline processes Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment. *Field Work* of up to three days is a compulsory part of the subject.

25.3261 Geochemical Analytical Techniques — S2 L1T1

Prerequisite: 25.311.

Modern destructive methods of rock and mineral analysis. Non-destructive methods; X-ray fluorescence spectroscopy and electron probe microanalysers.

25.3271 Advanced Structural Geology — S2 L1T1

Prerequisite: 25.221.

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 three days is a compulsory part of the subject.

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.

Geography

27.111 Applied Physical Geography 1 — F L2T3

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
2 unit Science (Geology) or	*31-100*
2 unit Science (Biology) or	*31-100*
4 unit Science (multistrand)	*31-100*

Excluded: 27.301, 27.311, 27.801, 27.811, 27.818, 27.828.

A systematic introduction to physical geography as a basis for applied studies. Principles of meteorology and climatology with particular emphasis on climatic controls at global and regional scales. Weather systems and forecasting methods. Climatic classification and the regional pattern of climates in Australia. Geologic and climatic factors in landforms and soils, and in the physiographic build and major landforms of Australia. Mass movement and hillslope form. River action and associated valley and channel forms. Coastal environments, processes and forms. Properties and types of soil, with emphasis on factors and processes controlling global and regional distribution. Soil profiles and laboratory measurement of soil properties. Principles of soil classification and mapping. Spatial organization of plants and animals, and factors and processes relating to that organization. Composition, structure, population dynamics and classification of vegetation. *Laboratory classes* concerned with the interpretation of various forms of data in physical geography and their representation quantitatively and graphically. *Field work* of up to five days is an integral part of the subject.

27.133 Pedology — S2 L2T3

Prerequisites: 27.111 or any two units from 2.111, 2.121, 2.131, 2.141, and 27.811 or 27.111 or 27.828 or 27.311 or 25.012 or 25.022 or 27.172.

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: 27.311/811 or 27.828 or 17.031 & 17.041 or 27.111 or 27.172.

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of man and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Composition, structure, productivity and environmental controls of heathland, woodland, grassland and rainforest communities. Management of vegetation in different climate regimes. *Field work* of up to five days is a compulsory part of the subject.

27.153 Climatology — S1 L2T3

Prerequisites: 1.001, 27.311/811 or 27.828 or 25.110 & 25.120 or 17.031 & 17.041 or 27.111.

Physical bases for understanding microclimate. Processes of energy exchange at the earth's surface, and the atmospheric and terrestrial surface controls of the heat and mass budgets. Atmospheric diffusion. Wind profiles and atmospheric turbulence as affected by stability and surface properties. Determinants of the local and site-specific climatic environment, particularly topographic, surface cover and substrate conditions. Urban climate and climate in relation to human comfort and health. Building and constructional design aspects of climate and applications of climatology in urban and regional planning. Climatic aspects of the development and regional planning. Climatic aspects of the development and utilization of solar and wind energy sources.

27.1711 Introduction to Remote Sensing — S1 L2T2

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 airphoto 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.

27.1712 Remote Sensing Applications — S2 L2T2

Prerequisite: 27.1711.

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.

27.172 Environmental Measurements — F L2T4

Prerequisites: 27.111; or 27.818 & 27.819; or 27.801 & 27.802; or 27.301 & 27.302.

Sampling strategies and survey methods for the collection of environmental data. Data analyses using laboratory and statistical methods. The collection and analyses of weather and climatic data, and the maintenance of meteorological stations. Methods of field surveying and instrumentation for the study of geomorphologic and hydrologic processes. Drainage basin morphometry, dynamics and function, including controls on run-off and sediment transport. The measurement of soil physical and chemical properties in the field and laboratory with special reference to plant growth and soil water and geomorphological processes. The relationships between weathering processes and soil properties. Methods of surveying, classifying and mapping soils. Measurement and description of vegetation. Vegetation survey, sampling and species abundance measure. Monitoring energy and nutrient flow and the effects of humans on ecosystems.

27.183 Geomorphology — S2 L2T3

Prerequisites: 25.110 & 25.120 or 27.311/811 or 27.828 or 27.111 or 27.172. Excluded: 27.860.

Beaches and their response to waves, currents and sediment movement. Barrier systems, lagoons and estuaries. Rock platforms. Quaternary sea level changes. Hydraulic geometry of stream channels, including effects of sediment transport and humans' activities. Hillslope form, process and associated slope materials. Methods of slope measurement, analysis and survey. Hillslope models. Systems approach, equilibrium concepts and modelling in landform studies. Field projects in coastal and fluvial geomorphology, and laboratory time is devoted to statistical exercises using data collected from maps, airphotographs and in the field.

27.295 Physical Geography for Surveyors — S1 L2T2

Fundamentals of physical geography. Landscapes of Australasia. Techniques of landscape appraisal. Laboratory classes to support the above, including map analysis, air photo interpretation and examination of soil properties. There is a compulsory one-day excursion.

27.862 Australian Environment and Natural Resources — S1 L2T2

Prerequisite: 27.111 or 27.311/811 or 27.312/812 or 27.828 or 27.829. Excluded: 27.872, 27.362.

Offered in alternate years.

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

27.863 Ecosystems and Man — S2 L2T2

Prerequisite: 27.111 or 27.311/811 or 27.312/812 or 27.828 or 27.829. Excluded: 27.873, 27.363.

Not offered in 1985.

The structure and functioning of ecosystems, humans' interaction with ecosystems; Australian case studies of ecosystem management, including pastoral, cropping, forestry, coastal and urban ecosystems.

Surveying

Note: Electronic Calculators.

Students enrolled in the surveying courses are required to equip themselves with an electronic calculator. Advice on the purchase of this equipment is given to students at the commencement of their course.

29.031 Electronic Distance Measurement — SS L2T1

Prerequisite: 29.005 (contact School for subject description).

Short range instruments: sources of error, field and computational methods of calibration, baseline design. Long range instruments: laser and microwave distance meters, sources of error, calibration, precise measurement techniques, geometric and atmospheric corrections. Properties of reflectors. Power sources.

29.032 Precise Surveys in Industry and Engineering — SS L2T1

Prerequisite: 29.006 (contact School for subject description).

Review of survey problems in industry and engineering. Setting-out of large structures: network design, measurements, methods of height transfer, optical plumbing, examples and accuracy requirements. Surveys for measurement of deformation and settlement: design of control network and stations, observation and adjustment techniques, detection of movement, electric measurement of small changes in length, height and inclination. Close-range indoor surveys: optical tooling, special equipment and techniques, auto-collimation, laser interferometry.

29.033 Characteristics of Modern Theodolites and Levels — SS L2T1

Prerequisites: 29.006 (contact School for subject description).

Construction features, sources of error and methods of testing modern optical surveying instruments. Topics selected from: circle and micrometer graduation errors, coded circles, calibration and behaviour of bubbles, automatic compensator systems, axis wobble, temperature effects.

29.034 Mine Surveying — SS L2T1

Prerequisite: 29.006 (contact School for subject description).

Statutory regulations. Mine plans and computations in three dimensions. Bore hole surveys. Surface and underground surveys. Transfer of azimuth, shaft plumbing and levelling. Subsidence surveys. Gyrotheodolite. Specialized equipment and techniques.

29.035 History of Surveying — SS L1T2

Historical development of geodesy, astronomy, cartography, photogrammetry, and geophysics. History of general surveying: mathematical aids, optics, instruments, electronic aids for surveyors. Selected topics from history of surveying and land law in Australia.

29.1010 Surveying 1 — S1 L2½T2½

Introduction to surveying. Revision of plane trigonometric formulae. Co-ordinate systems. Magnetic compass. Plane table surveys. Introduction to distance measurement. Tape measurement. Minor instruments. Detail surveys. Areas of regular and irregular figures.

29.1110 Computations 1 — S1 L1T1

Principles of calculation, rounding off, significant figures, estimation of orders of magnitude. Fundamentals of programming, introduction to Fortran, constant types, data elements, Fortran arithmetic, selection control, loop control, input and output. Program modules, documentation and presentation.

29.153 Adjustment of Control Surveys — SS L1½T1½

Prerequisite: 29.212.

Adjustment of control surveys on the ellipsoid. Statistical evaluation of the adjustment. Detection of outliers. Design and optimization of networks. Requires use of School computer program library.

29.161 Hydrographic Surveying 1 — S1 L3

Prerequisite: 29.006 (contact School for subject description).

Introduction, theory of echo sounder, sounding techniques, visual fixing, electronic position fixing, tides, tidal streams, tidal datums, ocean currents, acoustic and wire sweeps.

29.162 Hydrographic Surveying 2 — S2 L1T2

Prerequisite: 29.161.

Practical training: undertake a hydrographic survey requiring establishment of horizontal and vertical shore control, preparation of plotting sheets, control marking, bathymetry, equipment calibration, tidal observations and reduction, inking in. Static display of other equipment. Lectures on nature of seabed, wind waves, the survey report. Discussions on practical surveying tasks or topics of current interest. A harmonic analysis of 12 days of tidal data.

29.1710 Professional Orientation — S1 L1T½

The scope of surveying activities and their relationship to associated disciplines. Introduction to: geodesy and positioning from stars and satellites; map projections and coordinates; aerial photographs, maps and remote sensing, applications in resource surveys; cadastral, engineering and land development surveys, role of the consulting surveyor; mining and hydrographic surveys. Includes visits to surveying organizations.

29.173 Project — S1 or S2 T3

Prerequisite: High standard in the chosen topic area normally required; permission of project supervisor.

Theoretical or practical investigation of a selected topic under the guidance of a supervisor, with a report of a high academic standard required. Topic may be one suggested by the School or by the individual student based on his experiences.

29.174 Major Project — F T3 or S2 T6

Prerequisite: High standard in the chosen topic area normally required; permission of project supervisor.

An elective subject involving a detailed investigation of a selected or assigned topic under the guidance of a supervisor, with a report of a high academic standard required. Topic may be one suggested by the School or by the individual student based on his experiences.

29.196 Survey Camp 4

Co-requisite: 29.195 (contact School for subject description).

Two weeks of office computations equivalent to 84 contact hours. Preparation of comprehensive individual reports based on field survey tasks completed in Survey Camp 3.

29.2010 Surveying 2 — S2 L1½T2½

Principles of levelling. Methods, recording. Levelling instruments; testing and adjustment. Theodolites; principles and construction. Horizontal and vertical angle measurement.

29.2040 Survey Draughting — S2 L½T2½

Fundamentals of survey draughting. Abbreviations, symbols, sizes of drawing sheets, layout of drawing sheets, lines, letters, numerals, scales, projection and sectioning, dimensioning, architectural drawing, engineering survey and design drawings. Drawing practice in boundary surveying State regulations. Mapping signs and symbols recommended by the National Mapping Council. Topographic Cartography; representation of features, toponomy, map series, cartometry. Thematic cartography concepts.

29.2050 Survey Camp — S2

Co-requisites: 29.1010, 29.2010.

Detail Surveys using minor instruments, setting out using steel band and theodolite, levelling, compass and tape traversing between control.

29.212 Geodesy 2 — S1 L2T1

Co-requisites: 29.151, 29.211 (contact School for subject descriptions).

Principles of physical geodesy. Satellite applications in gravity determination. Principles of doppler, laser ranging to satellites and the moon, and very long base-line interferometry. Geodynamic applications. Methods of establishing a world geodetic system. Adjustment of control surveys using the condition and parametric methods of least square adjustment for measured angular and linear quantities. The role of the variance-covariance matrix, variance factors and the weight coefficient matrix. Elementary testing of observations and adjusted values.

29.213 Geodesy 3 — SS L3

Prerequisite: 29.212.

Topics from: advanced geodetic techniques and instrumentation-principles and applications; variations in geodetic position with time; earth satellite orbits; geoid solutions from gravimetry; earth's gravity field from satellite orbits; extension of gravity into unsurveyed regions.

29.231 Geophysics for Surveyors — SS L2T1

Interrelationship of geodesy and geophysics. The earth as a celestial body. Rotation and figure of the earth. Earth's interior. Principles of seismology, geohydrology, physical oceanography, tectonophysics, physics of atmospheric processes. Interrelationship of surveying and applied geophysics. Methods of geophysical exploration. Engineering and mining geophysics. Physics of mass movements.

29.232 Atmospheric Effects on Geodetic Measurements — SS L3

Development of refraction theory. Wave propagation in an inhomogeneous medium. Refractive properties of air. Principles of thermodynamics of gases, boundary and surface layer meteorology, structure of atmospheric turbulence. Meteorological measurements. Electromagnetic wave propagation in a turbulent medium.

29.3010 Surveying 3 — S1 L2½T2

Prerequisites: 29.1010, 29.2010. Co-requisite: 29.3110.

Theodolite errors; testing and adjustment. Control surveys. Traversing; methods, calculation and errors. Trigonometric and Barometric heighting. Hydrostatic levelling. Error propagation, precision, accuracy and testing.

29.3110 Computations 2 **S1 L3T1½**

Prerequisite: 29.1110.

Programming Strand: Operating systems, library programs, file structures, data base management, programming examples. *Computations Strand:* Algorithm development for traverse adjustment by Bowditch's method. Intersection and resection (unique solution and solution with redundant data), trilateration, semigraphic solution of mixed observations, missing data problems, road intersections, subdivision calculations, transformations. Spherical trigonometry.

29.312 Astronomy 2 **S1 L1½T½**

Prerequisite: 29.311 (contact School for subject description).

Determination of azimuth from circum-polar, circum-elongation and sun observations. Simultaneous determination of latitude and longitude by the position line method. Prediction of observation programs. Evaluation of precision of results.

29.313 Astronomy 3 **SS L2T1**

Prerequisite: 29.312.

Topics selected from: geodetic astronomical methods, daylight star observations, meridian and equal altitude methods, variation in star co-ordinates, sun dials, celestial methods in navigation.

29.4010 Surveying 4 **S2 L2½T2½**

Co-requisites: 29.3010, 29.3110.

Optical distance measurement. Principles of stadia method. Contouring. Horizontal staff tacheometers. Setting out surveys. Horizontal and vertical curves. Route surveys. Volume determination; methods, applications and calculations.

29.4050 Survey Camp **S2**

Prerequisite: 29.2050. Co-requisites: 29.3010, 29.4010.

Theodolite and steel band traverse; surveys by stadia. Road survey. Setting out of horizontal and vertical circular curves. Long section and cross sections.

29.4150 Electronics for Surveyors **S2 L1T1**

Prerequisite: 1.971.

Introduction to digital circuits and systems. Data transmission, recording and display.

29.4220 Introduction to Geodetic Science **S2 L2T1**

Prerequisites: 1.971, 10.001. Co-requisite: 10.022.

Historical development of geodesy. Scope and goals of contemporary geodesy. The earth's gravity field. The earth's motions in space. Foundation of celestial observations for position and azimuth determination. Time and time keeping. Coordinate systems and transformations. Earth satellite motion.

29.441 Surveying for Engineers **S1 or S2 L2T4**

Co-ordinate systems. Levelling. Theodolite and angular measurements. Distance measurements: steel band, electronic. Traversing. Tacheometry. Contour and detail surveys. Horizontal and vertical curves. Area and volume computations. Control, engineering and underground surveys. Outline of photogrammetry.

29.4520 Remote Sensing and Resource Surveys **S2 L1½T1½**

Land resource inventory surveys: general procedures. Remote sensing and its application to resource surveys. Variations of electromagnetic energy. Sensing systems. Elements of image interpretation. Computer assisted image analysis procedures. Sampling methods. Elementary statistics for areal sampling. Land classification systems. Reliability of class boundaries. Integrated resource surveys — concepts and specifications. Thematic and parametric surveys.

29.4710 Report Writing **S2 L1T1**

Requirements and purposes of technical reports. Introduction to the literature of surveying, literature searches. Characteristics of effective writing: structure, style, vocabulary. Citations and references. Exercises in technical writing, criticism and editing.

29.4810 Land Mangement and Development 1 **S2 L2T1**

Surveyor's role in land development. Variation of land use and land value: effect on land development. Urbanization and land use. Location theory. Public measures for directing land use; social, economic and locational determinants of land use; land on urban fringe. Introduction to valuation; factors affecting value of land; valuation principles for land use and subdivision.

29.491 Survey Camp

A one-week field camp for students studying 29.441 Surveying for Engineers.

29.5010 Surveying 5 **S1 L2T2½**

Prerequisite: 29.3010.

Precision theodolites; construction, errors and testing. Precise horizontal angle measurement. Electronic theodolites. Precise levelling; instruments, staves, errors. Field methods, marking and accuracy.

29.5110 Computations 3 **S1 L2T2**

Prerequisite: 29.3110.

Review of matrix algebra. General law of propagation of variances, variance factor, statistical testing, error ellipses for points and lines. Adjustment by least squares: **1.** parametric method; **2.** condition method. Solution and inversion of normal equations.

Includes a programming assignment.

29.512 Photogrammetry 2 — S1 L2T1

Prerequisite: 29.511 (contact School for subject description).

Review of relative and absolute orientation. Plotting, map compilation, relief representation, map reproduction. Map revision, radial line mapping from a single photo pair. Orthophotos and mosaics. Introduction to photogrammetric control extension, use of auxiliary data. Project planning: costs, scheduling, specifications, photogrammetric production capabilities and limitations. Non-topographic photogrammetry. Analytical methods.

29.513 Photogrammetry 3 — SS L2½T½

Prerequisite: 29.512.

Review of inner, relative and absolute orientation. Aerial triangulation: analogue continuous strip methods, method of independent models, analytical methods, block adjustments, accuracies, error propagation. Use of auxiliary data. Problems associated with solutions of large systems of equations. Camera calibration. Non-topographic applications.

29.514 Principles of Remote Sensing — SS L2T1

Brief history. Electromagnetic radiation. Definition and physics of basic quantities. Photographic film images and sensors. Electro-optical sensors. Microwave images and sensors. Data systems — ground truth, calibration, sampling, transmission, storage, retrieval, classification enchancement, restoration. Positioning considerations. Examples of operational systems.

29.5220 Geodetic Positioning — S1 L2T½

Prerequisites: 29.4220, 10.022, 10.341.

Terrestrial positioning. Horizontal and vertical control networks. Inertial surveys. Satellite positioning. TRANSIT and NAVSTAR GPS systems.

29.5230 Map Projections — S1 L2T½

Prerequisites: 10.022, 29.4220.

Principles of map projections. Surveying projections and grids. Transverse Mercator projections used in Australia. Scale-factor and arc-to-chord corrections on the Transverse Mercator projection.

29.5610 Cadastral Surveying and Land Law 1 — S1 L2½T1

The legal system in Australia and NSW; the nature of land law including land tenure, estates in land, interests in land; title systems in land; land administration in Australia and NSW Boundary surveying — controlling principles; cadastral mapping in NSW.

29.6010 Surveying 6 — S2 L2T2½

Prerequisite: 29.3010. Co-requisite: 29.5010.

Electronic distance measurement; principles, light modulation, pulse techniques. Propagation of electromagnetic waves, refractive index. Effects of temperature, pressure and humidity on measurement. Geometrical corrections. Electro-optical and microwave distance metres. Calibration.

29.6220 Field Astronomy — S2 L2T1

Prerequisite: 29.4220.

Introduction to the determination of latitude and longitude from meridian and prime vertical observations. Determination of azimuth from the sun and close circum-polar and circum-elongation stars. Simultaneous determination of latitude and longitude by position lines.

29.632 Land Inventory 2 — SS L2T1

Prerequisite: 29.512.

Principles and types of spatial information systems. Land and its attributes. Geocoding: concept of a spatial identifier; external index, topological, co-ordinate. Examples of polygon and segment oriented methods. Spatial searching. Use of digitizers. Examination of typical systems. Incorporation of remotely sensed data. Forms of presentation.

29.6510 Photogrammetry 1 — S2 L2T1

Prerequisite: 29.3110.

Remote sensing data acquisition systems; photography, electro-optical, linear array and micro-wave systems. Photograph geometry. Interior orientation. Stereoscopic vision. Collinearity equations and deviations from collinearity encountered in practice. Space resection. Relative orientation; concept procedure, error effects. Ground control selection, absolute orientation. Analogue stereo-plotter principles.

29.653 Land Development 3 — S1 L1T2

Design and studio project for a neighbourhood development. Constraint and site analysis: preparation of maps for land use and vegetation, surface and soils, drainage and terrain, slopes, climate and aspect, composite maps. Structure plan: residential precincts, schools, commercial areas, industrial areas, active and passive recreation, pedestrian ways and road hierarchy. Plan of detailed lot layout: consideration of access, grades, drainage reserves, parks, and pedestrian ways. Engineering design and plans: catchment details, longitudinal and cross-sections, drainage layout and longitudinal sections, flow schedule with calculations, longitudinal sections of kerb profiles.

29.654 Land Development 4 — SS L2T1

Prerequisite: 29.653.

Detailed study of the land development process. Role of local government. Alternative design concepts. Environmental problems associated with land development. Environmental impact statements, theory and methodology. Legal aspects and authorities. Economics as a constraint on development, costs, ranking of investment proposals. Application of quantitative mangement methods to staging and analysis of development projects.

29.6610 Cadastral Surveying and Land Law 2 — S2 L4T2

Prerequisite: 29.5610.

Survey investigation for both artificial and natural boundaries; survey and title searching; field note preparation for cadastral surveying; survey marking; preparation of plans of survey; study of appropriate

statutes and regulations; cadastral survey techniques for urban and rural properties; the role of coordinates in cadastral surveying.

The status of roads in NSW; identification surveys; consents for MHWM, railways, rivers, kerbs in Sydney, strata plan surveys including plan preparation; the surveyor as a professional; contract, partnership and corporations, liability; surveyors and the law, limitation periods, insurance, loss prevention; software packages for cadastral surveying.

29.663 Cadastral Surveying and Land Law 3 — SS L2T1

Prerequisite: 29.662 (contact School for subject description).

The relationship between land information systems, title and deed registration, cadastral surveying and the cadastre. Forms and components of land tenure and cadastral systems. Aspects related to the definition of the cadastre: cadastral mapping, integrated surveys and methods of defining land parcels.

29.664 Modern Title Concepts — SS L2T1

Prerequisite: 29.662 (contact School for subject description).

Past, present and future of group housing title concepts, Strata and cluster titles in NSW. Strata Titles Act, 1973. The development process related to group housing. Management of strata schemes. Feasibility studies for group housing.

29.6810 Land Management and Development 2 — S2 L2T1

Co-requisite: 29.5610.

Subdivision control in NSW; broad-acre subdivisions under Local Government and Planning and Environment Legislation; procedures and legal controls; review of subdivision design; engineering aspects.

29.7010 Surveying 7 — S1 L3½T1

Co-requisite: 29.6010.

Introduction to hydrographic surveys. Echo sounding; theory and practice. Visual fixing by transits, theodolite and sextant. Electronic position fixing; hyperbolic, range-range and satellite systems. Theory of tides. Tidal streams and currents. Tidal datums. Sweeping and searching. Statistical testing of observations. Multi-sample variance analysis. Correlated observations. Linear regression and prediction.

29.702 Seminar 2 — T1

Effective writing and speaking, increased emphasis on research of literature. Oral presentation by individual students on assigned topics in selected areas of surveying.

29.703 Seminar 3 — S2 L½T½

Effective communication. Technical writing for comprehension. Additional speaking experiences. Invited speakers on current areas of interest in surveying. Student critique of course.

29.704 Management 1 — S1 L2

Introduction to the social framework of business. Financial accounting methods and interpretation of financial statements. Finance and financial planning with emphasis on projects and small business. General management functions. Introduction to quantitative management methods and their application.

29.705 Management 2 — S2 L2

Professional responsibilities, legal aspects of professional practice. Principles of management and organization. Management functions. Quantative management methods. Project planning. Introduction to cost benefit analysis. Project and office management.

29.7050 Survey Camp — S1

Prerequisites: 29.5010, 29.6010, 29.5110, 29.5220, 29.6220, 29.6510, 29.5610, 29.6610.

Cadastral Surveying including astronomic observations for azimuth, land use survey including air photo and Landsat imagery interpretations. Photo control survey by traverse and resection, precise traverse and heighting with EDM. Preparation of reports based on field tasks completed.

29.7120 Computer Graphics — S1 L1T1

Prerequisite: 29.3110.

Computer graphics, especially in relation to computer assisted mapping and draughting. Acquisition, processing and presentation of data; graphics programming using a high level language and a graphics language; use of interactive graphics display terminals and plotters.

29.7220 Geodetic Computations — S1 L2T1

Prerequisites: 29.5220, 29.5110.

Elements of geodetic methodology; classes of mathematical models. Least squares solution of overdetermined models; assessment of results. Adjustment of control surveys. Solution of direct and inverse geodetic problems.

29.7510 Photogrammetry 2 — S1 L2½T1½

Prerequisite: 29.6510.

Analytical methods of relative and absolute orientation. Principles of analytical plotters. Map compilation by photogrammetric techniques. Map production. Differential rectification, orthophotos and mosaics. Map revision. Principles of aerial triangulation. Project planning; costs, scheduling, specifications, capabilities of photogrammetric production.

29.7810 Land Management and Development 3 — S1 L1T1

Prerequisite: 36.411.

Design and studio project for a residential neighbourhood development. Constraint and site analysis: preparation of maps of land use, vegetation, surface and soils, drainage and terrain, slopes, climate and aspect; composite overlay maps. Structure plan design: residential precincts, schools, commercial areas, industrial areas, active and passive recreation, pedestrian ways and road hierarchy.

29.8010 Surveying 8 — S2 L3T2

Prerequisite: 29.5010.

Calibration of linear scales. Principles and practice of autocollimation. Theodolite attachments. Setting out of large structures. Gyro-theodolite. Underground surveys. Plumbing of shafts and high structures. Azimuth and height transfer.

29.802 Cartography 2 — SS L1½T1½

Cartographic technology: characteristics of base materials, drawing techniques, scribing techniques, symbol and type preparation, photomechanical methods, screens and masks, colour registration, proofing methods, principles of lithography. Planning, costing and organizing cartographic work.

29.803 Mapping Technology — SS L1½T1½

Prerequisite: 29.512.

Production of base maps from aerial photographs, rectification theory, photographic mosaics, differential rectification and orthophotomaps, cartographic completion of photomaps. Automation of cartographic processes, data collection and processing, plotting software and hardware, digital terrain models.

29.8220 Global Geodesy — S2 L2T½

Prerequisite: 29.5220. Co-requisite: 29.7220.

Astro-geodetic methods. Gravimetric geodesy. Space geodetic methods. Combined methods. Variations of geodetic positions with time. Geophysical applications.

29.8510 Photogrammetry 3 — S2 L2T1

Co-requisite: 29.7510.

Analytical methods in photogrammetry. Aerial triangulation block adjustment by models and bundles. Control requirements, accuracies of aerial triangulation. Camera Calibration. Application in non-topographic methods using metric and non-metric systems. Digital elevation models. Computer assisted mapping techniques in photogrammetry.

29.8710 Seminar — S2 L1T½

Prerequisite: 29.4710.

Introduction to characteristics of effective speaking. Oral presentation by individual students on topics in selected areas of surveying. Participation in colloquia by invited speakers on current topics in surveying. Student assessment of degree course.

29.8720 Management — S2 L2

Introduction to business management. Types of business. Financial accounting methods and interpretation of financial statements; finance and financial planning for small business. Principles of management and organization. Professional responsibilities. Management records. Managing people in small business.

29.8810 Land Management and Development 4 — S2 L1T1

Prerequisites: 8.6140, 8.6150. Co-requisite: 29.7810.

Continuation of design and studio project for a residential neighbourhood development. Plan of detailed lot layout: consideration of access, grades, drainage reserves, parks and pedestrian ways. Engineering design and plans: catchment details, road longitudinal and cross-sections, drainage layout, flow schedule, hydraulic grade line calculations, longitudinal sections of kerb profiles.

29.9010 Advanced Surveying Instruments — S1 or S2 L2T1

Prerequisites: 29.5010, 29.6010.

Electronic tacheometers: types, construction, circle reading devices, on-line correction of instrument errors. Data storage mediums, data transfer between tacheometer and recorder and between recorder and computer. Electronic field books. High performance gyroscopic theodolites: construction, measuring process and accuracy. Two-colour and high precision electronic distance meters: principle, operation, calibration, accuracy. Microwave distance meters: new developments, ground-swing problem, measuring techniques, calibration. Long range EDM: measurement techniques, calibration of instruments.

29.9020 Hydrographic Surveying — S1 or S2 L1T2

Prerequisite: 29.7010.

Practical training: a hydrographic survey requiring establishment of horizontal and vertical shore control, preparation of plotting sheets, control marking, bathymetry, equipment calibration, tidal observations and reduction, inking in. Other navigational equipment. Nature of seabed, wind waves, the survey report. Discussions on practical surveying tasks or topics of current interest. Harmonic analysis of tidal data.

29.9030 Precise Engineering Surveying — S1 or S2 L2T1

Prerequisites: 29.5010, 29.6010.

Review of survey problems in industry and engineering. Surveys for large structures — location, setting out and control during construction, monitoring of deformation and settlement: high precision mechanical, optical and electronic equipment for distance measurement, levelling, horizontal and vertical alignment, local deformation. Network design, station marking, observation techniques, data presentation, deformation and settlement analysis including free network solutions. Close-range surveys: optical tooling, laser interferometry. Positioning and alignment of machine components, optical positional constraints, scale and azimuth control.

29.9090 Project — S1 or S2 T3

Prerequisite: High standard in the chosen topic area normally required; permission of project supervisor.

Theoretical or practical investigation of a selected topic under the guidance of a supervisor, with a report of a high academic standard required. Topic may be one suggested by the School or by the individual student based on his or her experiences.

29.9210 Adjustment of Control Networks **S1 or S2 L1½T1½**

Prerequisite: 29.7220.

Adjustment of control surveys on the ellipsoid. Statistical evaluation of the adjustment. Detection of outliers. Design and optimization of networks. Requires use of School computer program library.

29.9220 Advanced Geodetic Positioning **S1 or S2 L2T1**

Prerequisite: 29.5220.

Precise aspects of terrestrial and extraterrestrial reference frames; units, constants, coordinate systems and transformations used in satellite positioning; modelling of measurements. Orbit determination. Positioning with GPS; field procedures. Inertial surveying systems: inertial frame; sensors; mathematical and error models; filtering and smoothing processes; post-mission adjustment techniques; inertial positioning methods and applications.

29.9520 Remote Sensing Principles **S1 or S2 L1½T1½**

Prerequisite: 29.4520.

Definition and physics of basic electromagnetic quantities, atmospheric effects, photographic film images and sensors, thermal infrared sensing, radar, radar sensing, electro-optical sensors. Choice of sensor and data processing. Remote sensing project.

29.9530 Land Information Systems **S1 or S2 L2T1**

Land information systems and computer-assisted mapping; land information as maps and records; computerization of land information; data acquisition from ground surveys, aircraft and satellite mounted sensors; data acquisition from maps and air photographs; data storage methods; data structures; data processing, transformations, searching, sorting; data base management systems; interactive graphical editing; data output including computer plotters and software packages; cartographic presentation; an examination of existing systems in Australia and overseas.

29.9610 Modern Cadastral Concepts **S1 or S2 L2T1**

Prerequisite: 29.6610.

An analysis of the operation and components of a modern cadastral survey system, especially the relationship between title, conveyancing, surveying and mapping. Components of land tenure and cadastral systems; statewide parcel based land information systems; cadastral models. Horizontal and vertical subdivision, trends in group housing in Australia and overseas, ownership alternatives including strata titles, management of strata schemes, the development process related to strata subdivision.

29.9910 Special Topic in Surveying A **S1 or S2 L2T1**

A special subject to be lectured on by visiting professors or other visiting staff. Details of syllabus and lecturer to be communicated to Faculty on each occasion when the subject runs.

29.9920 Special Topic in Surveying B **S1 or S2 T3**

A special subject taken by a group of students by private study in conjunction with tutorial sessions with the member(s) of staff in charge of the subject.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Faculty of Architecture Handbook.

29.411 Surveying for Architects and Builders **S1 L1T1½ C2**

A compulsory subject. Prerequisites: nil.

Introduction. Chaining, methods of measurement, corrections, chain surveys. Level, differential levelling, booking. Contours, volumes of earthworks. Theodolite, methods of reading angles, applications in building. Traversing, setting out.

29.901 Introduction to Mapping **S1 L1T½**

Mapping: map types, map reading, scale, relief, depiction of features, cartography and photogrammetry. *Remote Sensing:* cameras and other sensors. Landsat images and applications. *Cadastral surveying:* land titles, surveys, easements and covenants.

Organizational Behaviour

30.935G Organization Behaviour A **S1 L3**

Organizations are examined as open systems exhibiting a variety of structural patterns within an external, economic, social, political and technological environment which is uncertain and rapidly changing. Against this background the subject lays the foundations for gaining insight into human behaviour in organizations.

Town Planning

36.411 Town Planning **S1 L2T1**

Architecture prerequisite: 11.4308 and 100 credit points.

Introduction to the purpose, scope and application of planning. The urban planning process. Objectives and means of planning cities. Levels of planning and types of plans: state environmental policies, regional environmental plans, local environmental plans. Problems in planning: equitable distribution of resources. Environment and environmental impact statements. Planning law and administration. Future of cities.

Chemical Engineering and Industrial Chemistry

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.

48.403 Polymer Science — S1 or S2 L2T1

Prerequisites: 2.002A, 2.002B, 10.031, 10.301. Co- or prerequisites: 48.001, 48.113.

Polymerization processes; stepgrowth and chain growth (free radical and ionic), stereospecific catalysts. Methods of polymerization: bulk suspension, emulsion, solution, high pressure. Industrial examples. Principles of analysis of polymers using chemical and instrumental methods. Molecular weight applied to macromolecules: number-, weight-, viscosity- and z-average weights. Molecular weight distribution. Thermodynamics of polymer solutions, theta solvent. Measurement of molecular weight. Fractionation methods. Conformation of a polymer chain. The crystalline state. The amorphous state. Stress/strain behaviour. Creep. Impact. Rubber elasticity. Dynamic mechanical properties. Principles of operation of polymer processing equipment; safety procedures. Polymer compound design.

Anatomy

70.011C Introductory Anatomy — S1 L2T4

Prerequisites: 17.031, 17.041.

Introduction to gross anatomy, based on a study of prosected specimens. Musculoskeletal, cardiovascular, respiratory, gastrointestinal, genitourinary and nervous systems. General topographical and surface anatomy. Normal variations including those related to sex and age.

70.306 Functional Anatomy 1 — S1 L2T4

Prerequisite: 70.011C.

Introduction to fundamental issues in the morphology and dynamics of human movement systems. Includes: physical properties of bone, muscle and connective tissue; biomechanics, movement analysis and neuromuscular control. These basic principles are applied to a detailed study of musculoskeletal components of head and neck and upper limb. Emphasis on modern analytical techniques and findings. Tutorials include detailed limb and joint dissections plus intensive study of surface and radiological anatomy.

Law

90.502 Industrial Safety and Health Law — S1 Hpw4 C3

The law relating to compensation for work-related injuries and disabilities and to the regulation of safety standards in industry and of the processes and substances employed therein. *Topics include:* the employer's common law duty of care; the development and application of workers' compensation schemes; comprehensive no-fault compensation schemes and inquiries relating thereto in their application to industrial injuries and disabilities; existing protective legislation in Australia; a comparative survey of protective legislation in other countries and its effectiveness; proposals for amendment of protective legislation; individual rights under protective legislation; regulation of industrial safety and health under compulsory arbitration schemes; management and union initiatives in the fields of industrial safety and health; new problems in industrial safety and health.

Graduate Study:

Course Outlines

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1985 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1985* 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 School of Engineering

In November 1964 the Council of the University approved the establishment of the Graduate School of Engineering to co-ordinate and develop the graduate activities of the Faculty.

Through its Schools and Centres for Biomedical Engineering and Remote Sensing, the Faculty provides excellent facilities for well-qualified graduates to engage in advanced studies and research. The Faculty awards seven higher degrees as follows: *Research* — Doctor of Philosophy, Master of Engineering and Master of Surveying; *Course Work Masters* — Master of Engineering Science (available in a number of areas of specialization), Master of Surveying Science, Master of Safety Science and Master of Biomedical Engineering. In addition, the degrees of Doctor of Science and Master of Science may be awarded for research conducted in, or in association with, the Faculty of Engineering.

The administration of the various awards including admission, progress and assessment of all higher degree and diploma candidates is conducted by the Higher Degree Committee of the Faculty under the general supervision of the Faculty of Engineering.

Conditions governing the award of higher degrees and graduate diplomas are set out later in this handbook in **Conditions for the Award of Higher Degrees.** However, conditions for the award of the degree of Doctor of Science may be found in the University Calendar.

Research Degrees

Doctor of Philosophy PhD

This degree is awarded for a thesis considered to be a substantially original contribution to the subject concerned. The degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories.

Admission Guidelines A candidate for registration for the degree of Doctor of Philosophy should hold an honours degree from the University of New South Wales or an honours degree of equivalent standing from another approved university. Applications for admission should be made to the

Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

Period of Candidature The normal period is six academic sessions (full-time) and eight academic sessions (part-time) from the date of enrolment. In special cases the minimum period of registration may be reduced by up to two academic sessions. The maximum period of registration is ten academic sessions (full-time) and twelve academic sessions (part-time). In special cases an extension of these times may be granted.

Master of Engineering/Master of Science/ Master of Surveying ME/MSc/MSurv

These are research degrees in which a thesis embodies the result of an original investigation, or design, or engineering/ surveying development. Candidates for the degree of ME and MSurv may be required to carry out a program of advanced study.

Admission Guidelines A candidate for registration for the degree of Master of Engineering, Master of Science or Master of Surveying should hold a Bachelor's degree from the University of New South Wales or from another approved university. Applications for admission should be made to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

Period of Candidature The normal period is four academic sessions (full-time) and six academic sessions (part-time) from the date of enrolment. In special cases the minimum period of registration may be reduced by up to two academic sessions. The maximum period of registration is eight academic sessions (full-time) and twelve academic sessions (part-time). In special cases an extension of these times may be granted.

Research degrees may be undertaken in the Faculty of Engineering as follows:

Degree	School/Course	Course Code
PhD	Civil Engineering	1630
	Electrical Engineering and Computer Science	1641
	Mechanical and Industrial Engineering	1660
	Nuclear Engineering	1670
	Surveying	1680
	Biomedical Engineering	1710
ME	Civil Engineering	2650
	Electrical Engineering and Computer Science	2661
	Mechanical and Industrial Engineering	2690
	Nuclear Engineering	2700
MSurv	Surveying	2720
MSc	Civil Engineering	2750
	Electrical Engineering and Computer Science	2761
	Mechanical and Industrial Engineering	2780
	Nuclear Engineering	2785
	Biomedical Engineering	2795

Course Work Masters Degrees

Master of Engineering Science/Master of Surveying Science MEngSc/MSurvSc

These are Faculty-wide degrees allowing for flexibility of choice between formal course work and research. The schools in the Faculty have developed recommended programs of study leading to specialization in certain areas.

Candidates are required to complete a program totalling 36 credits* for formal course work. Alternatively a degree may be awarded for the completion of formal course work and a report on a project or completion of a thesis only. The number of credits for a project report are 9 or 18, and 36 for a thesis.

Candidates may undertake interdisciplinary studies and, subject to approval, are able to take subjects from any school in the Faculty, other faculties of the University and other universities or institutions. By means of this system, programs of studies best suited to the needs of the candidates may be selected.

Before enrolment an applicant should submit an intended program for approval by the school/division offering the majority of the credits to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools or institutions.

Admission Guidelines An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of certain requirements.

Applicants for admission to a course of study leading to the award of a course work Masters degree should apply to the

*See definition of 'credit' under **Graduate Subjects** later in this section.

Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin. It may be necessary to limit entry to some formal courses because of available resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature The normal period is two academic sessions (full-time) or four academic sessions (part-time) from the date of enrolment. The maximum period of candidature is four academic sessions (full-time) and eight academic sessions (part-time). In special cases an extension of time may be granted. A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

Master of Biomedical Engineering MBiomedE

This degree is primarily obtained through course work but includes a project report conducted in either a hospital or other institution. The course of study offers scope for original research into the application of engineering principles and technology to medical problems. Candidates must complete a program totalling 60 credits, 40 of which must be for the study of subjects at graduate level.

Admission Guidelines An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is usually required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of certain requirements.

Applicants for admission to a course of study leading to the award of a course work Masters degree should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin.

Period of Candidature The normal period is three and one third academic sessions (full-time) or six academic sessions (part-time) from the date of enrolment. The maximum period of candidature is six academic sessions (full-time) and twelve academic sessions (part-time).

Master of Safety Science MSafetySc

The Master of Safety Science is an interdisciplinary course involving the study of the principles of engineering, law, management, medicine and science as applied to the field of occupational safety.

Admission Guidelines An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of certain requirements.

Applicants for admission to a course of study leading to the award of a course work Masters degree should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin. It may be necessary to limit entry to some formal courses because of available resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature The normal period is three academic sessions (full-time) and six academic sessions (part-time) from the date of enrolment. The maximum period of candidature is six academic sessions (full-time) and ten academic sessions (part-time). In special cases an extension of time may be granted. A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

Courses of Study

Courses of study leading to the award of course work Masters degrees may be undertaken in the Faculty as follows:

Degree	School/Course	Course Code
MEngSc	Electrical Engineering and Computer Science	8500
	Industrial Engineering	8530
	Mechanical Engineering	8540
	Nuclear Engineering	8550
	Civil Engineering	8610
	Surveying	8640
MSurvSc	Surveying	8650
MBiomedE	Biomedical Engineering	8660
MSafetySc	Safety Science	8670

A program in **Remote Sensing** is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends upon the background of the applicant and the orientation of the proposed program.

A program in **Arid Lands Management**, to which the Faculty of Engineering contributes, is available in the Faculty of Applied Science (course code **8025**). Details are available from the Faculty of Applied Science Handbook.

Subjects available in the Faculty of Engineering are listed toward the end of this section. However, not all electives are offered in any particular year. Subject descriptions appear in the following chapter of the handbook.

Course Work Programs

Detailed information is available from the schools offering the courses.

8500
Electrical Engineering and Computer Science

Master of Engineering Science
MEngSc

- All candidates must commence in Session 1 and possess an appropriate level of knowledge for the subjects chosen.
- All candidates elect to study in one of the specific programs offered by the School of Electrical Engineering and Computer Science: each Program Co-ordinator will advise if applicants are adequately qualified to undertake the proposed subjects and must approve the chosen program.

All candidates must register in one of the following programs:

		Program Co-ordinator
8501	Communications	Dr C. J. E. Phillips
8502	Electric Power	Dr T. R. Blackburn
8503	Electronics	Dr H. S. Blanks
8504	Computer Science	A/Prof. A. Dunworth
8505	Systems and Control	Dr R. F. Brown

In an all course work program of 36 credits (ie 12 subjects) at least 9 subjects from the program area must be chosen and up to 3 from other areas. Where an 18 credit project is approved, a lesser number of subjects is taken.

After a transition period, the programs will require more specific core subjects to be studied.

8530
Industrial Engineering
8540
Mechanical Engineering

Master of Engineering Science
MEngSc

A major field of study is required to be nominated and two-thirds of the 36 credits required for the degree must be taken in that major field. (Examples of major fields are heat engines, fluid mechanics, solar energy, etc. Consult School Advisers for further details.)

All candidates take either a 9 credit or 18 credit project on a topic in their major field.

Formal lecture subjects are not restricted to the School of Mechanical and Industrial Engineering, Faculty or University, but two-thirds of all credits must be taken at the University of New South Wales.

In consultation with their School Adviser, candidates at enrolment put together a program which is based on these requirements, but which may be modified from time to time in the light of changes in availability of subjects. These requirements also apply to a number of specialist courses which are offered by the School of Mechanical and Industrial Engineering and which are described below.

Specialist Programs

1. Refrigeration and Air Conditioning

16 credits of core subjects:

		Credits
5.151-2G	Refrigeration and Air Conditioning Design 1, 2	3,3
5.716-7G	Advanced Heat Transfer 1, 2	3,3
5.751-2G	Refrigeration, Air Conditioning and Cryogenics 1, 2	2,2

2 credits of approved options from subjects offered by this School or elsewhere

and

18 credit Project Report

or

9 credit Project plus 9 credits from:

5.074	Computer Science for Mechanical Engineers	2
5.075-6G	Computational Methods in Mechanical Engineering 1, 2	2,2
5.806G	Digital Logic Fundamentals for Mechanical Engineers	3
5.087G	Microprocessor Fundamentals for Mechanical Engineers	3
5.328-9G	Control and Modelling of Mechanical Systems 1, 2	3,3
5.345-6G	Analogue, Non-Linear Control Systems 1, 2	3,3
5.653-4G	Acoustic Noise 1, 2	2,2
5.655G	Energy Conservation and System Design	3
5.722G	Solar Thermal Energy Design	3
5.758G	Refrigeration and Air Conditioning Applications	4
35.426G	Building Services	3

or such other subjects as may be approved by the Head of School.

2. Industrial Automation

18 credits of core subjects taken from:

		Credits
5.086G	Digital Logic Fundamentals for Mechanical Engineers	3
5.087G	Microprocessor Fundamentals for Mechanical Engineers	3
5.089G	Elements of Industrial Automation	3
5.090G	The Analysis and Use of Integrated CAD/CAM Systems	3
5.328G	Control and Modelling of Mechanical Systems	3
6.460G	Real Time Computing and Simulation	3
18.260G	Computer Aided Programming for Numerical Control	3

and
18 credit Project Report
or
9 credit Project *and* a further 9 credits from subjects selected from:

		Credits
5.075G	Computational Methods in Mechanical Engineering 1	2
5.088G	Industrial Applications of Microprocessors	3
5.317G	Industrial Robotics	3
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	3
6.467G	Digital Image Processing, Scene Analysis and Machine Vision	3
18.772G	Information Processing Systems in Organizations	2
18.878G	Industrial Applications of Mathematical Programming	2

or such other subjects as may be approved by the Head of School

3. Industrial Management

3 credits of core subjects:

		Credits
18.074G	Industrial Management	3
18.965G	Industrial Management Seminar	0

at least 11 credits selected from:

14.062G	Accounting for Engineers	3
18.380G	Methods Engineering	4
18.571G	Operations Research 1	6
18.675G	Economic Decisions in Industrial Management	3
18.776G	Production and Inventory Control	2
and		
18.909G	Project	9
or		
18.918G	Project Report	18

The remaining credits may be selected from:

14.042G	Industrial Law	2
15.565G	Industrial Relations	3
18.061G	Industrial Experimentation 1	3
18.075G	Decision Support Systems	2
18.171G	Inspection and Quality Control	3
18.360G	Ergonomics	3
18.371G	Factory Design and Layout	3
18.464G	Value Analysis/Engineering	3
18.465G	Computer-Aided Manufacturing	3
18.672G	Decision Theory for Industrial Management	3
18.764G	Management of Distribution Systems	2
18.772G	Information Processing Systems in Organizations	2
18.862G	Linear Programming	2
18.862G	Nonlinear Programming	2
18.870G	Large Scale Optimization in Industry	3
18.878G	Industrial Applications of Mathematical Programming	2
28.913G	Marketing Management	3

or such other subjects as may be approved by the Head of School

4. Operations Research

Prerequisites:
(i) 2 years of University level Mathematics
(ii) minimum 40 hours University level course in Probability and Statistics (*or* enrolment in 5.0721 Computing or equivalent as a co-requisite)
(iii) minimum 40 hours University level course in Engineering Economic Analysis (*or* enrolment in 18.675G Economic Decisions in Industrial Management as a co-requisite)
(iv) competence in computer programming (*or* enrolment in 5.0721 Computing as a co-requisite).

12 credits of core subjects:

		Credits
14.062G	Accounting for Engineers	3
18.571G	Operations Research 1	6
18.574G	Management Simulation	3
18.970G	Operations Research Seminar	0
18.909G	Project	9
or		
18.918G	Project Report	18

The remaining credits may be selected from:

18.074G	Industrial Management	3
18.075G	Decision Support Systems	2
18.360G	Ergonomics	3
18.371G	Factory Design and Layout	3
18.380G	Methods Engineering	4
18.464G	Value Analysis/Engineering	3
18.671G	Decision Theory	2
18.672G	Decision Theory for Industrial Management	3
18.673G	Energy Modelling, Optimization and Energy Accounting	3
18.675G	Economic Decisions in Industrial Management	3
18.761G	Simulation in Operations Research	3
18.764G	Management of Distribution Systems	2
18.765G	Optimization of Networks	2

		Credits
18.772G	Information Processing Systems in Organizations	2
18.776G	Production and Inventory Control	2
18.862G	Linear Programming	2
18.863G	Nonlinear Programming	2
18.870G	Large Scale Optimization in Industry	3
18.874G	Dynamic Programming	2
18.879G	Mathematical Programming Analysis	3

or such other subjects as may be approved by the Head of School

5. Advanced Analysis for Design

Prerequisites:
(i) 5.123 Mechanical Engineering Design 3 or equivalent
(ii) 5.423 Mechanics of Solids 3 or equivalent

21 credits of core subjects:

		Credits
5.414G	Finite Element Applications	3
5.415G	Stress Analysis for Mechanical Engineering Design 1	3
5.417G	Mechanics of Fracture and Fatigue	3
5.909G	Project (Design and Build)	9
18.360G	Ergonomics	3

plus at least 5 credits selected from:

5.1242	Design Technology	2
5.1244	Design Management	2
5.1245	Computer Based Engineering Design (or 18.870G)	2
5.403G	Experimental Stress Analysis	3
6.044	Electrical Product Design and Reliability (or 6.576G)	3
6.576G	Reliability Engineering (or 6.044)	3
8.731G	Project Management (or 8.732G)	3
8.732G	Advanced Project Management Theory (or 8.731G)	3
18.464G	Value Analysis/Engineering	3
18.675G	Economic Decisions in Industrial Management	3
18.870G	Large Scale Optimization in Industry (or 5.1245)	3

The remaining credits, resulting overall in at least 36 credits, must be chosen from an approved list of subjects, details of which may be obtained from the School of Mechanical and Industrial Engineering.

8610
Civil Engineering

Master of Engineering Science
MEngSc

The School of Civil Engineering offers a large number of graduate subjects which allow the flexibility of many combinations to provide relevant groupings both in an academic and professional sense. The main technical groupings are:

- civil engineering materials
- engineering construction and management
- structural engineering
- transport engineering
- water engineering

All candidates are required to undertake a project with the other credits being obtained from formal course work. Full details of preferred programs in the various specialist areas are available from the School.

Remote Sensing Program

Master of Engineering Science
MEngSc

Note: The course code for this program varies according to the School in which the candidate gains admission.

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.

		Credits
Compulsory subjects		
6.580G	Image Analysis in Remote Sensing	3
6.587G	Computing Techniques in Remote Sensing Image Analysis	3
27.043G	Remote Sensing Applications	3
29.601G	Remote Sensing Principles and Procedures*	6
29.605G	Ground Investigations for Remote Sensing	3

*Includes Group Practical Exercise in Remote Sensing, 3 credits.

Project	
Project in Remote Sensing† *or*	9
Research Project in Remote Sensing†	18

†The subject number for these subjects varies according to the school in which the candidate is enrolled.

Elective subjects

Candidates are required to include additional subjects selected from the following listed elective subjects, or from other relevant subjects offered within the University, as approved by the appropriate Head of School, to complete a program totalling 36 credits.

		Credits
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	3
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	3
6.468G	Computer Display Systems and Interactive Instrumentation	3
6.611	Computing 1	4
6.621	Computing 2A	3
25.816G	Remote Sensing	2
27.642	Mathematical Methods for Spatial Analysis	2
27.643G	Geographic Data Analysis	2
27.672G	Geographic Information Systems	2
27.911G	Soil Erosion and Conservation	6
29.520G	Photogrammetric Production Processes	3
29.604G	Land Information Systems	3

8650
Surveying

Master of Surveying Science
MSurvSc

Programs of study leading to the degree of MSurvSc are offered by the School of Surveying in a range of topics including:

- advanced surveying
- geodesy
- photogrammetry
- land development and management
- land information systems

Candidates are allowed a wide choice in selecting programs. Subjects can be selected to suit individual student needs and typical programs can be supplied by the School on request. The program of study must total at least 36 credits. One credit is normally equal to attendance for one hour per week for one session but some senior undergraduate subjects may be taken for partial credit towards the degree. The program normally includes a Project of 9 credits or a Project Report of 18 credits. Examples of suitable external subjects are electronic computing, statistics, oceanography and a range of others.

8660
Biomedical Engineering

Master of Biomedical Engineering
MBiomedE

The program of study must total 60 credits and include at least 40 credits at graduate level.

Strand A subjects are directed to candidates with an engineering/physical sciences background and Strand B to those with a medical/biological sciences background. Selection of subjects is not limited to those listed below: relevant approved subjects from other areas may be undertaken. A research project is compulsory and may be undertaken concurrently with other subjects. An 18 credit Project Report is the normal requirement.

Session 1 (March-June)

Strand A

			Credits
73.111	Physiology 1A (full year)	C	6
70.011C	Introductory Anatomy	HR	6
42.211G	Principles of Biology		3
42.212G	Principles of Biochemistry		3
32.012G	Biomedical Statistics		4
32.020G	Radiation Physics		4
32.510G	Introductory Biomechanics§		3
32.561G	Mechanical Properties of Biomaterials*		3

Strand B

32.510G	Introductory Biomechanics		3
32.501G	Computing for Biomedical Engineers	HR	4
32.101G	Mathematical Modelling for Biomedical Engineers	C	4
32.040G	Analogue Electronics for Biomedical Engineers		4
32.020G	Radiation Physics		4
32.012G	Biomedical Statistics		4
6.021E	Digital Logic and Systems		4

Session 2 (July-November)

73.111	Physiology 1A	StrA	6
32.611G	Medical Instrumentation†		3
32.541G	Mechanics of the Human Body*		3
32.332G	Biocompatibility		3
32.321G	Physiological Fluid Mechanics		4
32.311G	Mass Transfer in Medicine		4
32.050G	Microprocessors and Circuit Design for Biomedical Engineers‡		4
32.010G	Biomedical Engineering Practice	HR	2
18.360G	Ergonomics		3
6.471G	Compartmental System Analysis		3

For Session 3 and footnotes, see overleaf

Session 3 (March-June)			Credits
72.402G	Principles of Disease Processes**		3
32.030G	Thesis†† *or*		30
32.018G	Project Report†††	C	18
32.621G	Biological Signal Analysis		3
32.701G	Dynamics of the Cardiovascular System		3
32.551G	Biomechanics of Physical Rehabilitation*		3

C Compulsory
HR Highly Recommended
StrA Strand A only

§For students with no mechanics background.

*These three electives vary according to sessions offered. Prerequisite 32.510G or equivalent.

†Prerequisite 32.040G or equivalent.

‡Prerequisite 32.501G and 32.040G or equivalents.

**For non-medical graduates only. Prerequisite 73.111 or equivalent; pre- or co-requisite 70.011C.

††Research project may be done concurrently with course work during the other sessions. An 18 credit Project Report is the normal requirement.

8670
Faculty of Engineering

Master of Safety Science
MSafetySc

Candidates are required to complete a program totalling 54 credits made up of preliminary subjects (selected according to previous qualifications), 22 credits of compulsory subjects and Engineering Safety electives, and a 9 credit Project. The preliminary subjects enable graduates from a wide range of disciplines (such as engineering, science, medicine, economics, law) to reach an adequate standard of comprehension for studying the compulsory and elective subjects.

Preliminary Subjects

Statistics and Computing		Credits
No more than 4 credits selected from:		
16.901G	Health Services Statistics 1	2
32.012G	Biomedical Statistics	4
32.501G	Computing for Biomedical Engineers	4
47.010G	Basic Fortran	2
47.015G	Programming in BASIC	2

Management		Credits
Either:		
18.074G	Industrial Management	3
or		
30.935G	Organizational Behaviour A	3
Plus the following subjects:		
47.051G	Principles of Solid Mechanics	3
70.201G	Introductory Functional Anatomy†	3
80.701	Occupational Disease	3
47.900G	Introductory Law	2

Compulsory Subjects

47.120G	Human Behaviour and Safety Science	3
18.360G	Ergonomics	3
47.180G	Management for Safety	3
80.702	Occupational Health Control	3
90.502	Industrial Safety and Health Law	4
47.330G	The Accident Phenomenon	3
47.052G	Introduction to Safety Engineering	3

Safety Engineering Electives

39.908G	Community Noise Control	2
47.054G	Machines and Structures Safety	3
47.070G	Ventilation	3
47.480G	Fire and Explosion	3
47.060G	Electrical Safety	3
47.230G	Radiation Protection	3
18.380G	Methods Engineering	4
47.481G	Management of Dangerous Materials	3
2.251G	Toxicology, Occupational and Public Health	6

Project

47.909G	Project	9
or		
47.918G	Project Report	18

†Subject to approval

Graduate Diplomas

Courses of study leading to the award of a graduate diploma provide engineers with the opportunity to update their professional knowledge in their own speciality. These courses also give candidates access to a program of study in other areas which are relevant to their professional activities. The subjects offered have been specially chosen for these reasons and many of them are available by tape correspondence and/or television broadcasts in the Sydney metropolitan area. The graduate diploma courses in **Engineering Developments** are intended for those who wish to take a more general program in several areas of interest.

Before enrolment, an applicant should submit an intended program for approval by the school/division offering the majority of the credits to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools of the University. Candidates must complete a program totalling 30 credits. Forty per cent of these may consist of approved undergraduate subjects and the program may contain subjects from other schools of the Faculty, other faculties of the University and other universities or institutions.

Admission Guidelines An applicant for admission to a graduate diploma course should be a graduate of the University of New South Wales or other approved university or have other qualifications as may be approved by the Faculty of Engineering. Applicants should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin. It may be necessary to limit entry because of available resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature The normal period is two academic sessions (full-time) or four academic sessions (part-time) from the date of enrolment. The maximum period of candidature is four academic sessions (full-time) and eight academic sessions (part-time). A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

Courses of study leading to the award of a graduate diploma may be undertaken in the Faculty of Engineering as follows:

School/Course	Course Code
Engineering Developments	
Civil	5471
Biomedical	5472
Electrical	5473
Industrial	5475
Mechanical	5476
Nuclear	5477
Surveying	5478
Highway	5430
Transport	5460
Safety Science	5480
Surveying	5490
Remote Sensing*	5495

*The Graduate Diploma in Remote Sensing is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends upon the background of the applicant and the orientation of the proposed program.

Further details of programs of study may be obtained from the schools concerned.

Subjects available in the Faculty of Engineering are listed at the end of this section. However, not all electives are offered in any particular year. Subjects available by tape correspondence, as well as all subject descriptions, appear later in this handbook.

If an applicant nominates a course of study from the foregoing list, at least half of the credits should come from subjects offered by the relevant course authority.

Graduate Subjects

The subjects which may be available for a candidate proceeding to the award of the degree of Master of Engineering Science, Master of Safety Science, Master of Surveying Science, Master of Biomedical Engineering and Graduate Diploma are listed below under the various schools. Not all electives are necessarily offered in any particular year.

Under the credit system in operation in the Faculty, one credit is normally equal to one hour's attendance per week for one session. The qualification 'normally' is required because of the varying ways in which credits are distributed for course work, design, critical review or research in the different schools.

Safety Science

		Credits
47.051G	Principles of Solid Mechanics	3
47.052G	Introduction to Safety Engineering	3
47.054G	Machines and Structures Safety	3
47.060G	Electrical Safety	3
47.070G	Ventilation	3
47.120G	Human Behaviour and Safety Science	3
47.180G	Management for Safety	3
47.230G	Radiation Protection	3
47.330G	The Accident Phenomenon	3
47.480G	Fire and Explosion	2
47.481G	Management of Dangerous Materials	3
47.900G	Introductory Law	2
47.909G	Project	9
47.918G	Project Report	18

Subjects offered by Tape Correspondence

		Credits
5.075G	Computational Methods in Mechanical Engineering 1	2
5.076G	Computational Methods in Mechanical Engineering 2	2
6.378G	Solar Energy Conversion	3
6.379G	Solar Cells — Operating Principles, Technology and System Applications	3
47.010G	Basic Fortran*	2
47.015G	Programming in BASIC*	2
47.031G	Linguistics, and Written and Spoken Communication*	1
47.032G	Basic Information Theory*	1
47.034G	Psychology of Communication*	2
47.038G	Body in Communication*	1
47.043G	Presentation of Information*	1
47.345G	Active and Adaptive Circuits for Integrated Systems*	3

*Enrolment subject to approval.

Civil Engineering

Department of Transport Engineering

		Credits
8.401G	Human Factors in Transport	3
8.402G	Transport, Environment, Community	6
8.403G	Theory of Land Use/Transport Interaction	3
8.404G	Local Area Transport Planning	3
8.405G	Urban Transport Planning Practice	3
8.406G	Regional Transport Planning	3
8.407G	Transport System Design (Non-Urban)	3
8.408G	Transport System Design (Urban)	3
8.409G	Interchange Design	3
8.410G	Highway Engineering Practice Part 1	3
8.411G	Highway Engineering Practice Part 2	3
8.412G	Economics for Transport Studies	3
8.413G	Transport Economics	3
8.414G	Transport Systems Part 1	3
8.415G	Transport Systems Part 2	3
8.416G	Traffic Engineering	6
8.417G	Transport and Traffic Flow Theory	6
8.418G	Statistics for Transport Studies Part 1	3
8.419G	Statistics for Transport Studies Part 2	3
8.420G	Transport Engineering Elective	3

Department of Engineering Construction and Management

8.701G	Economic Decision Making in Civil Engineering	3
8.702G	Network Methods in Civil Engineering	3
8.703G	Optimization Techniques in Civil Engineering	3
8.704G	Stochastic Methods in Civil Engineering	3
8.705G	Systems Modelling	3
8.706G	Experimental Methods in Engineering Research	3
8.707G	Numerical Methods in Civil Engineering	3
8.710G	Advanced Topics in Optimization in Civil Engineering	3
8.714G	Advanced Topics in Systems Modelling	3
8.723G	Construction Design	3
8.724G	Construction Technology	3
8.725G	Construction Accounting and Control	3
8.726G	Construction Law and Professional Practice	3
8.727G	Construction Planning and Estimating	6
8.728G	Design of Construction Operations	6
8.731G	Project Management	3
8.732G	Advanced Project Management Theory	3

Department of Civil Engineering Materials

8.748G	Pavement Materials 1	3
8.749G	Pavement Materials 2	3
8.750G	Pavement Design and Evaluation 1	3
8.751G	Pavement Design and Evaluation 2	3
8.752G	Terrain Engineering	6
8.753G	Soil Engineering	3
8.754G	Applied Soil Mechanics	3
8.755G	Materials of Construction (Concrete Technology) 1	3
8.758G	Soil Mechanics	3
8.760G	Materials of Construction (Concrete Technology) 2	3
8.764G	Composites in Civil Engineering	3
8.766G	Welding in Structural Engineering	3
8.771G	Foundation Engineering	6
8.773G	Materials of Construction (Metals) 3	3
8.774G	Soil Dynamics	3
8.775G	Geotechnical Aspects of Natural Hazards	3
8.776G	Rock Mechanics	3
8.777G	Numerical Methods in Geomechanics	3
8.778G	Geotechnical Processes for Energy Resources	3
8.779G	Building Materials Technology in Third World Countries	3
8.780G	Geological Engineering	3

Department of Structural Engineering

8.802G	Elastic Stability 1	3
8.803G	Elastic Stability 2	3
8.804G	Vibration of Structures 1	3
8.805G	Vibration of Structures 2	3
8.806G	Prestressed Concrete 1	3
8.807G	Prestressed Concrete 2	3
8.808G	Prestressed Concrete 3	3
8.809G	Reinforced Concrete 1	3
8.810G	Reinforced Concrete 2	3
8.811G	Reinforced Concrete 3	3
8.812G	Plastic Analysis and Design of Steel Structures 1	3
8.813G	Plastic Analysis and Design of Steel Structures 2	3
8.814G	Analysis of Plates and Shells	3
8.817G	Experimental Structural Analysis I	3
8.818G	Bridge Design 1	3
8.819G	Bridge Design 2	3
8.820G	Structural Analysis and Finite Elements 1 (SAFE 1)	3

		Credits
8.821G	Structural Analysis and Finite Elements 2 (SAFE 2)	3
8.822G	Structural Analysis and Finite Elements 3 (SAFE 3)	3

Department of Water Engineering

8.830G	Hydromechanics	3
8.831G	Closed Conduit Flow	3
8.832G	Pipe Networks and Transients	3
8.833G	Free Surface Flow	3
8.835G	Coastal Engineering 1	3
8.836G	Coastal Engineering 2	3
8.837G	Hydrological Processes	3
8.838G	Flood Design	3
8.839G	Advanced Flood Estimation	3
8.840G	Reservoir Design and Yield Determination	3
8.841G	Hydrometeorology	3
8.842G	Groundwater Hydrology	3
8.843G	Groundwater Hydraulics	3
8.844G	Soil-Water Hydrology	3
8.846G	Urban Drainage Design	3
8.847G	Water Resources Policy	3
8.848G	Water Resources System Design	3
8.849G	Irrigation	3
8.850G	Drainage of Agricultural Lands	3
8.851G	Unit Operations in Public Health Engineering	3
8.852G	Water Distribution and Sewage Collection	3
8.854G	Solid and Liquid Waste Management	2
8.855G	Water and Wastewater Analysis and Quality Requirements	3
8.856G	Water Treatment**	3
8.857G	Sewage Treatment and Disposal**	3
8.858G	Water Quality Management**	3
8.860G	Investigation of Groundwater Resources 1	3
8.861G	Investigation of Groundwater Resources 2	3
8.862G	Fluvial Hydraulics	3
8.863G	Estuarine Hydraulics	3
8.864G	Arid Zone Hydrology	3
8.865G	Arid Zone Waters Resources Management	3

Other Subjects

8.901G	Civil Engineering Elective 1	3
8.902G	Civil Engineering Elective 2	3
8.909G	Project	9
8.918G	Project Report	18
8.936G	Thesis*	36

*A 36 credit Thesis is not normally approved in the School of Civil Engineering. The normal program includes a 9 credit Project.

**Students specializing in Public Health Engineering normally study 42.211G Principles of Biology and 42.214G Biotechnology in the School of Biotechnology.

Electrical Engineering and Computer Science

Department of Communications

		Credits
6.050G	Occasional Elective — Digital Signal Processing	3
6.150G	Communication Elective — Applied Optoelectronics	3
6.164G	Microwave Antenna Theory and Applications	3
6.169G	Microwave Circuits: Theory and Techniques	3
6.170G	Microwave Electronics	3
6.336G	Digital Communication Networks	3
6.337G	Sound Broadcast Systems	3
6.338G	Television Systems	3
6.339G	Electroacoustics	6
6.344G	Communication Theory	3
6.345G	Analogue and Digital Filters	3
6.347G	Digital Communications	3
6.348G	Optical Communications	3
6.349G	Radar and Navigation Aids	3

Department of Electric Power Engineering

6.221G	High Voltage Technology	3
6.224G	Partial Discharges in Electrical Insulation	3
6.227G	Insulation Performance in Electrical Plant	3
6.228G	Power System Equipment	3
6.229G	Fields and Materials	3
6.234G	Power System Protection	3
6.242G	Power System Analysis	3
6.250G	Power Elective 1	3
6.251G	Power Elective 2	3
6.256G	Underground Systems	3
6.257G	Electric Power Distribution Systems	3

Department of Electronics

6.550G	Solid State Electronics Elective	3
6.573G	Advanced Semiconductor Devices	3
6.575G	Integrated Circuit Technology	3
6.576G	Reliability Engineering	3
6.577G	Integrated Circuit Design	3
6.578G	Solar Energy Conversion	3
6.579G	Solar Cells — Operating Principles, Technology and System Applications	3
6.580G	Image Analysis in Remote Sensing	3
6.587G	Computing Techniques in Remote Sensing	3

Department of Systems and Control

6.433G	Applied Microprocessor Design	3
6.453G	Computer Methods of Optimization	3
6.455G	System Identification and Modelling	3
6.456G	General Concepts in Formal System Theories	3
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	3
6.459G	Control Computing	3
6.460G	Real Time Computing and Simulation	3
6.464G	Digital Estimation, Prediction and Control	3
6.466G	Computer-Aided Design of Multivariable Control Systems	3

		Credits
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	3
6.468G	Computer Display Systems and Interactive Instrumentation	3
6.470G	Advanced Topics in Control — Robotics, Automation and Productivity Technology	3
6.471G	Systems and Control Elective — Compartmental System Analysis	3
6.484G	Biological Signal Analysis	3

Department of Computer Science

6.650G	Computer Science Elective — VLSI System Design	3
6.651G	Digital Electronics	3
6.654G	Digital Systems	3
6.655G	Computer Organization and Architecture	3
6.656G	Software Systems A	3
6.657G	Software Systems B	3

Other Subjects

6.073G	Precise Electrical Measurements	3
6.074G	Superconductivity	3
10.061G	Advanced Mathematics 1	3
10.361G	Statistics	3

Project or Thesis

6.909G	Project (not available)	9
6.918G	Project Report (not normally approved for part-time students)	18
6.936G	Thesis (not normally approved for part-time students)	36

Mechanical and Industrial Engineering

		Credits
5.045-6-7G	Advanced Topics in Mechanical Engineering	2,2,2
5.048G	Advanced Topic in Mechanical Engineering	3
5.049G	Advanced Topic in Mechanical Engineering	3
5.073G	Ordinary Differential Equations in Mechanical Engineering	3
5.075-6G	Computational Methods in Mechanical Engineering 1, 2	2,2
5.087G	Microprocessor Fundamentals for Mechanical Engineers‡	3
5.088G	Industrial Applications of Microprocessors	3
5.089G	Elements of Industrial Automation‡	3
5.090G	The Analysis and Use of Integrated CAD/CAM Systems	3
5.151-2G	Refrigeration and Air Conditioning Design 1, 2*	3,3
5.307-8G	Dynamics 1, 2	3,3
5.317G	Industrial Robotics	3
5.318-9G	Advanced Mechanism Analysis and Synthesis 1, 2	3,3
5.328-9G	Control and Modelling of Mechanical Systems 1‡, 2	3,3
5.335G	Vibrations	2
5.336G	Random Vibrations	2
5.345G	Analogue Control Systems	3
5.346G	Non-Linear Control Systems	3
5.403G	Experimental Stress Analysis	3
5.414G	Finite Element Applications	3
5.415-6G	Stress Analysis for Mechanical Engineering Design 1, 2	3,3
5.417G	Mechanics of Fracture and Fatigue	3
5.601G	Computational Fluid Dynamics	3
5.616-7G	Internal Combustion Engines 1, 2	3,3
5.621-2G	Gasdynamics 1, 2	2,2
5.631-2G	Lubrication Theory and Design 1, 2	2,2
5.653-4G	Acoustic Noise 1, 2	2,2
5.655G	Energy Conservation and System Design	3
5.716-7G	Advanced Heat Transfer 1, 2*	3,3
5.722G	Solar Thermal Energy Design	3
5.751-2G	Refrigerations, Air Conditioning and Cryogenics 1, 2*	2,2
5.758G	Refrigeration and Air Conditioning Applications*	4
5.909G	Project	9
5.912-3G	Naval Hydrodynamics 1, 2	2,2
5.918G	Project Report	18
5.936G	Thesis§	36

*Candidates wishing to specialize in Refrigeration and Air Conditioning should select this subject.

‡Candidates wishing to specialize in Industrial Automation should select this subject.

§A 36 credit thesis is not normally approved in the School of Mechanical and Industrial Engineering.

Department of Industrial Engineering

18.061G	Industrial Experimentation 1	3
18.062G	Industrial Experimentation 2	3
18.074G	Industrial Management	3
18.075G	Decision Support Systems	2
18.171G	Inspection and Quality Control	3
18.260G	Computer Aided Programming for Numerical Control	3
18.261G	Computer Automation	3
18.360G	Ergonomics	3
18.371G	Factory Design and Layout	3
18.461G	Design for Production	4
18.464G	Value Analysis/Engineering	3
18.465G	Computer-Aided Manufacturing	3
18.571G	Operations Research 1	6
18.574G	Management Simulation	3
18.579G	Case Studies in Operations Research	3
18.671G	Decision Theory	2
18.672G	Decision Theory for Industrial Management	3
18.673G	Energy Modelling, Optimization and Energy Accounting	3
18.675G	Economic Decisions in Industrial Management	3
18.761G	Simulation in Operations Research	3
18.763G	Variational Methods in Operations Research	2
18.764G	Management of Distribution Systems	2
18.765G	Optimization of Networks	2

		Credits
18.770G	Stochastic Control	2
18.772G	Information Processing Systems in Organizations	2
18.774G	Applied Stochastic Processes	2
18.775G	Networks and Graphs	2
18.776G	Production and Inventory Control	2
18.777G	Time Series and Forecasting	2
18.778G	Scheduling and Sequencing	2
18.779G	Game Theory	2
18.862G	Linear Programming	2
18.863G	Non-Linear Programming	2
18.870G	Large Scale Optimization in Industry	3
18.871G	Mathematics for Operations Research	2
18.874G	Dynamic Programming	2
18.875G	Geometric Programming	2
18.876G	Advanced Mathematics for Operations Research	2
18.878G	Industrial Applications of Mathematical Programming	2
18.879G	Mathematical Programming Analysis	3
18.965G	Industrial Management Seminar	0
18.967G	Advanced Topic in Production Engineering	2
18.968G	Advanced Topic in Production Engineering	2
18.969G	Advanced Topic in Production Engineering	2
18.970G	Operations Research Seminar	0
18.975G	Advanced Topic in Industrial Engineering	3
18.976G	Advanced Topic in Industrial Engineering	3
18.977G	Advanced Topic in Operations Research	2
18.978G	Advanced Topic in Operations Research	2
18.979G	Advanced Topic in Operations Research	2
18.909G	Project	9
18.918G	Project Report	18
18.936G	Thesis†	36

Note 1: Candidates taking their Projects in Industrial Management are generally required to take 18.074G and 18.965 plus at least 11 credits from 18.380G, 18.571G, 18.675G, 18.776G and 14.062G Accounting for Engineers. Before enrolling in the Projects they must have had one year's relevant industrial experience and have access to industry for their Project topics.

Note 2: Candidates taking their Projects in Operations Research are generally required to take 18.571G, 18.574G, 18.970G and 14.062G Accounting for Engineers.

Note 3: All Master of Engineering Science candidates in the Department of Industrial Engineering must include 18.909G or 18.918G in their programs.
†A 36 credit Thesis is not normally approved in the School of Mechanical and Industrial Engineering.

Nuclear Engineering

Head of School
Professor J. J. Thompson

		Credits
23.013G	Neutron Transport and Diffusion	3
23.015G	Multigroup Reactor Theories	3
23.023G	Reactor Thermal Performance	3
23.028G	Reactor Accident and Safety Analysis	3
23.032G	Mathematics Analysis and Computation	3
23.033G	Matrix Theory and Computation	3
23.042G	Nuclear Fuel and Energy Cycles	3
23.043G	Nuclear Power Costing and Economics	3
23.045G	Uranium Enrichment Technology	3
23.909G	Project	9
23.918G	Project Report	18
23.936G	Thesis	36

Surveying

		Credits
29.101G	Aspects of Electromagnetic Distance Measurement	3
29.102G	Characteristics of Optical Surveying Instrumentation	3
29.103G	Precise Engineering Surveys	3
29.106G	Special Topic in Surveying A	3
29.107G	Special Topic in Surveying B	3
29.151G	Adjustment of Observations	3
29.171G	Mathematical Methods 1 — Numerical Analysis	3
29.172G	Mathematical Methods 2 — Statistical Theory of Survey Observations	3
29.173G	Mathematical Methods 3 — Spherical Harmonics	3
29.174G	Mathematical Methods 4 — Theory of Survey Adjustment	3
29.175G	Mathematical Methods 5 — Collocation	3
29.201G	Geodetic Methods	3
29.202G	Earth and Ocean Dynamics	3
29.203G	Gravimetric Geodesy	3
29.204G	Geodetic Refraction	3
29.205G	Satellite Geodesy	3
29.206G	Advanced Geodetic Instrumentation	3
29.207G	Doppler Positioning	3
29.314G	Geodetic Astronomy	6
29.516G	Mathematical Model of the Imaging Process	3
29.517G	Stereophotogrammetry	3
29.518G	Analytical Photogrammetric Orientation	3
29.519G	Photogrammetric Instrumentation	3
29.520G	Photogrammetric Production Processes	3
29.521G	Control Extension A	3
29.522G	Control Extension B	3
29.601G	Remote Sensing Principles and Procedures	6
29.602G	Mass Appraisal Methods	3
29.603G	Statutory Control of Land Development	3
29.604G	Land Information Systems	3
29.605G	Ground Investigations for Remote Sensing	3
29.706G	Survey Management	3
29.707G	Quantitative Management Methods	3
29.909G	Project	9
29.918G	Project Report	18
29.936G	Thesis	36

Centre for Biomedical Engineering

Director
Associate Professor P. C. Farrell

		Credits
32.009G	Project	9
32.010G	Biomedical Engineering Practice	2
32.012G	Biomedical Statistics	4
32.018G	Project Report	18
32.020G	Radiation Physics	4
32.030G	Thesis	30
32.040G	Analogue Electronics for Biomedical Engineers	4
32.050G	Microprocessors and Circuit Design for Biomedical Engineers†	4
32.101G	Mathematical Modelling for Biomedical Engineers	4
32.311G	Mass Transfer in Medicine	4
32.321G	Physiological Fluid Mechanics	4
32.332G	Biocompatibility	3
32.501G	Computing for Biomedical Engineers	4
32.510G	Introductory Biomechanics	3
32.541G	Mechanics of the Human Body‡	3
32.551G	Biomechanics of Physical Rehabilitation‡	3
32.561G	Mechanical Properties of Biomaterials‡	3
32.611G	Medical Instrumentation*	3
32.621G	Biological Signal Analysis	3
32.701G	Dynamics of the Cardiovascular System	3
72.402G	Principles of Disease Processes††	3

†Prerequisite 32.501G and 32.040G or equivalents.

‡These 3 electives vary according to session offered. Prerequisite 32.510G or equivalent.

*Prerequisite 32.040G or equivalent.

††For non-medical graduates only. Prerequisite 73.111 or equivalent; pre- or co-requisite 70.011C.

Graduate Diploma Subjects

Graduate Diploma programs in all schools of the Faculty may include subjects from the above list, subject to the approval of the Head of School responsible for the subject.

In addition the following subjects are offered specifically for Graduate Diploma candidates. Not all electives are necessarily offered in any particular year.

School of Electrical Engineering and Computer Science

		Credits
6.060G	Microprocessor Systems	3
6.167G	Propagation and Transmission of Electromagnetic Waves	3
6.340G	Communication Electronics	3
6.341G	Signal Analysis	3
6.343G	Digital and Analogue Communications	3
6.452G	Feedback Control 1	3
6.457G	Cybernetic Engineering	3
6.472G	Feedback Control 2	3
6.481G	Introductory Physiology for Engineers	3
6.659G	Date Bases and Networks	3
6.660G	Design and Analysis of Algorithms	3
6.661G	Business Information Systems	3
6.662G	Computing Practice	3

School of Mechanical and Industrial Engineering

		Credits
5.086G	Digital Logic Fundamentals for Mechanical Engineers	3
18.380G	Methods Engineering	4
18.580G	Operations Research	6
18.681G	Engineering Economic Analysis	3
18.780G	Production Control	2
14.001	Introduction to Accounting A	3
14.002	Introduction to Accounting B	
14.042G	Industrial Law	2
14.062G	Accounting for Engineers	3

Project Reports and Theses

Supervision of project reports and theses will generally be available in the following areas of research interest in the Schools of the Faculty. Alternatively, design and other topics may be chosen by arrangement.

Civil Engineering

Engineering Construction and Management
Construction techniques. Equipment selection.
Field studies of spatial layout, material flow, and construction operations.
Micro, macro, and system structure of construction operations.
Civil engineering management.
Critical path methods, and operations research methods in engineering construction.
Information flow requirements and decision processes of office and field agents.

Engineering Materials
Application of finite element techniques to analysis of raft foundations, pile foundations, layered soils, and rigid retaining structures, marine structures, reinforced earth.

Structure — foundation interaction analysis for space frames supported on a raft foundation — static and dynamic states.
Stabilization of soils by thermal treatment.
Influence of defects on strength and deformation of rocks.
Theoretical and experimental studies of blasting hard rocks.
Corrosion, fatigue and fracture of metals.
Pavement analysis and management.
Skid resistance of pavements.
Rehabilitation of pavements.
Resource investigations by acoustic holograph.
Effect of stress history on concrete.
Specification of concrete.
Indigenous material studies.

Groundwater

Water movement in unsaturated soils.
Pollutant movement in soils.
Salinity studies.
Groundwater studies.

Hydrology

Flood estimation.
Yield and reservoir studies.
Hydrological instrumentation, data collection, and processing.
Mathematical rainfall-runoff models.
Stochastic hydrology.
Hydrological processes.
Hydrometeorology.
Urban drainage.
Arid Lands Hydrology.

Hydraulics

Two-fluid systems with small density differences.
Sediment motion.
Air entrainment in water in open channels and closed conduits.
Wave action and coastal engineering.
Flow through porous media.
Hydraulic transportation of solids.
Coastal engineering and breakwater stability.
Closed conduit flow.

Prestressed Concrete Structures

Partially prestressed concrete beams.
Analysis and design of end blocks for post-tensioned beams.

Public Health Engineering

Sewage sludge conditioning and filtration.
Clarifiers and sedimentation in water and waste water treatment.
Filtration.
Fluidized bed aerobic and anaerobic treatment.
Aerobic digestion.
Nutrient control.
Treatment of high strength waste waters.
Chemical fixation of hazardous wastes.

Reinforced Concrete Structures

Torsion, bending and shear in reinforced concrete and prestressed concrete beams.
Creep and shrinkage effects in reinforced concrete structures.
Shear and torsion in reinforced concrete flat slab floors.

Structural Analysis

Development of computer methods for the analysis of multi-storey flat plate structures.
Development and application of finite element techniques.
Investigation of elastic stability.
Analysis of dynamic response of highway bridges and buildings.

Transport Engineering

Problems of land use and transport interaction.
Theories of traffic structure and flow.
Measurements, planning and control of traffic.
Transport systems analysis.
Transport and the environment — accidents, energy, intrusion, noise and pollution.
Investigation of human factors.
Economic evaluation of transport investments.
Transport planning — local, urban and regional systems.
Investigations into transport economics, policy and decision-making.
Investigations of the geometric shape of the road alignment on the driver's view of the road.
Study of road alignment design in three dimensions.

Water Resources Engineering

Multi-objective water resources planning.
Hydro-economic studies.
Optimization problems in water resource systems design.
Drought studies.
Flood plain management.
Arid Lands Management.

Electrical Engineering and Computer Science

Communications

Optical communications.
Optical fibres and integrated optics.
Digital communications.
Digital radio and modulation methods.
Computer communications and local area networks.
Switching and stored program control systems.
UHF and microwave circuits and devices.
Microwave measurements.
Antennas and phased arrays.
Radar and navigational aids.
Signal processing and analysis.
Active and adaptive filtering.
Digital filters.
Acoustic and seismic signal processing.
Digital image processing.
Microprocessor and other digital signal processing chip applications.
Electronic music.

Systems and Control

Boiler-turbine modelling, control and simulation.
Digital systems and digital signal processing.
Design of non-linear filters for improved noise performance.
Computer aided design.
Analysis and design of dc/dc converters.
Microprocessor technology in control systems and information displays.
Optimal control computation.
Biomedical engineering: gait analysis, compartmental modelling, physiological systems modelling.
Medical applications of microprocessors.
Cybernetic engineering and advanced robotics: pattern, image and scene analysis, learning machines, vision and assembly.
Electric vehicle control and optimisation.
Records storage system development.
High speed facsimile links for document transfer.

Electric Power

The stability, dynamics and control of electric power systems.
Instrumentation and protection in power systems.
Electrical contacts.
Electrical measurements and data acquisition.
Superconductivity.
Electrical machines and thyristor control schemes.
Electromagnetic compatibility.
High voltage and heavy current phenomena.
Insulation research: partial discharge, detection and location.
Transients on transmission lines.
Wind power generation and integration.
Electrical equipment for hazardous atmospheres.
Arcing fault characteristics.
Gaseous insulation.
Load management and control.

Computer Science

Computer organization.
Computer graphics.
Artificial intelligence.
Operating systems.
Languages.
Scheduling.
Network projects.
Data base machine projects.
Computer aided design.
Computer aided instruction projects (CAI)
Fault tolerant computer systems.
Office automation and electronic publishing.
Computer aids for dyslexic children.
Digital systems description languages.
Integrated circuit and logic testing.
VLSI systems.

Electronics

Semiconductor device physics.
Integrated circuit design.
Integrated circuit technology.
Surface elastic wave devices.
Reliability engineering.
Photovoltaic solar energy conversion.
Computer-aided IC design.
Dry etching.
Remote sensing.

Mechanical and Industrial Engineering

Agricultural Engineering

Mechanical harvesting of fruit and vegetables.
Mechanical handling, grading and processing of agricultural produce.
Development of shearing equipment.
Metering and placement of seed and fertilizer.

Applied Mechanics

Biomechanics.
Mechanics of solids, stress analysis.
Impact mechanics.
Adaptive control systems.
Process stimulation and control.
Spatial and planar mechanisms.
Dynamics of machines.
Rotor bearing dynamics.
Multi-mode vibrations.
Lubrication and wear.
Hydrodynamic dampers.
Computer aided design.
Industrial automation.

Fluid Mechanics/Thermodynamics — including Aeronautical Engineering and Naval Architecture

Two-phase flow with and without heat transfer. Slurries.
Conveying of solid dusts by gases.
Hydraulic transients.
Hydrodynamics, water hammer. Fluidics.
Conduction, convection and radiation. Natural convection.
Computational fluid dynamics and heat transfer.
Refrigeration and air conditioning.
Energy conversion and conservation.
Solar energy and systems.
Engine performance and emissions.
Gas dynamics. Transonic flow. Shock waves.
Jets, turbulent mixing. Noise. Hot wire and optical measuring methods.
Large scale structures.
Light aircraft design and performance.
Development of a ship structure optimization system.
Analysis and design of plated grillages.
Vortex shedding in aeronautical and maritime engineering.
Economic studies relative to ship industry.
Hydrodynamics of planing surfaces.
Problems in wave resistance.
Finite element methods.

Industrial Engineering — Including Operations Research and Production Engineering

Engineering economic analysis.
Efficiency of production lines.
Optimum shearing policies for rolled bars.
Application of probability theory in the allocation of engineering tolerance.
Computer generation of timetables.
Job shop scheduling.
Least-cost tolerance.
Optimum reject allowance.
Operational simulation.
Variety reduction.
Probabilistic networks.
Optimization techniques relevant to information processing systems.
Statistical decision theory.
Production scheduling for variable demand.
Inventory and production control.
Optimum control.
Mathematical programming.
Dynamic programming.
Geometric programming.
Integer programming.
Large scale optimization.
Applications of operations research to real-world problems.
Stochastic processes.
Applications of optimization techniques.
Experimental and theoretical investigations of the following processes: machining, extrusion, indentation, compression, rolling, drawing.
Performance of single and multipoint cutting tools including tool life and economics of machining.
Properties of materials at high rates of strain.
Materials handling studies.
Factory design and location studies.
Plant layout by computer.
Ergonomics.
Occupational safety and health.
Production design studies.
Engineering design analysis and tolerance technology.
Metrology studies.
Group technology studies.

Nuclear Engineering

Neutron transport and diffusion theory.
Thermal and thermo-mechanical analysis of reactor components.
Nuclear reactor noise theory and analysis.
Nuclear fuel cycles.
Reactor channel hydrodynamics.
Numerical methods for reactor analysis and simulation.
Nuclear power planning and reactor strategy.
Risk assessment.
Radiation processing.

Surveying

Geodesy

Physical geodesy, geoid and gravimetric studies.
Satellite geodesy and precise orbit determinations.
Geodynamics: crustal motion studies using satellite laser ranging and very long baseline interferometry data, effects of mass movements on polar motion.
Satellite altimetry analysis, sea surface topography, unification of vertical datums.
Geometric geodesy and geodetic surveying, Doppler positioning determination methods, geodetic astronomy.
Positioning with GPS.
Effects of atmosphere on distance, angular and levelling measurements.
Adjustments and error theory: applications in geodesy and photogrammetry.
Solution of large systems of equations.
Adjustment of continental control networks.

Photogrammetry and Cartography

Production and evaluation of orthophotos and other map products.
Applications of digital techniques in cartography.
Monocular and stereoscopic pointing to photographic images, applications to ground targets, instrument cursors, cartographic symbolization.
Geometry of image sensors, remote-sensing imaging devices.
Non-topographic applications.
Restoration of digital image data.
Design of analytical plotter software.
Aerotriangulation, computer applications, block adjustment, independent model triangulation.
Digital terrain models.
Land and spatial information systems.
Remote sensing techniques particularly in urban areas.
Computer assisted mapping.

Land Studies

History and development of the Torrens Systems of title registration.
Land tenure, land registration and cadastral surveying systems.
Strata and cluster developments.
Land development and management.
Environmental assessment.
Applications of synthetic aperture radar.

Surveying

Deformation and settlement of structures.
Industrial applications of surveying.
Electronic distance measurements: high precision applications, calibrations.
Gyrotheodolite theory and applications.
Development of instrumentation.
Modern optical instrument testing.
Computation systems for desk top computers.

Biomedical Engineering

Modelling of respiratory function, cardiovascular function, nervous system, artificial kidney therapy, extracorporeal heart-lung support, endocrine system and other body systems.
Microprocessor control of medical equipment.
Limb and joint dynamics studies.
Development of implantable electrodes.
Development of rehabilitation devices.
Statistical analysis of patient therapy and modes of patient treatment.
Development and evaluation of new hospital equipment and treatment procedures.
Signal analysis of wave forms from medical diagnostic equipment.
Implants for fracture support and joint replacement.
Improved drug administration.

Remote Sensing

Director
Dr J. A. Richards

Development of committee and related classifier algorithms for use with multitemporal data.
Context classification.
Incorporation of auxiliary data into classification procedures.
Application of satellite data to Urban Area Studies.
Monitoring land use change using remotely sensed data.
Determining the characteristics of surface reflectance.
Analysis of image quality.
Application of satellite imagery to small scale mapping.
Multispectral linear transformations.
Application of spaceborne synthetic aperture radar data.

Graduate Study:

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.

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.

The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being the General Studies subjects. For General Studies subjects see the **General Studies 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.

Information Key

The following is the key to the information which may be supplied about each subject:

- S1 (Session 1); S2 (Session 2)
- F (Session 1 *plus* Session 2, ie full year)
- S1 or S2 (Session 1 *or* Session 2, ie choice of either session)
- SS (single session, but which session taught is not known at time of publication)
- CCH class contact hours
- L (Lecture, followed by hours per week)
- T (Laboratory/Tutorial, followed by hours per week)
- hpw (hours per week)
- C (Credit *or* Credit units)
- CR (Credit Level)
- DN (Distinction)

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Chemistry

2.251G Toxicology, Occupational and Public Health — F L1T2

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.

Mechanical and Industrial Engineering

5.045G Advanced Topic in Mechanical Engineering — C2

5.046G Advanced Topic in Mechanical Engineering — C2

5.047G Advanced Topic in Mechanical Engineering — C2

5.048G Advanced Topic in Mechanical Engineering — C3

5.049G Advanced Topic in Mechanical Engineering — C3

Subjects which may be offered by a Visiting Professor for graduate credit.

5.073G Ordinary Differential Equations in Mechanical Engineering — C3

Excluded: 5.072G or equivalent.

Solutions and their meaning, integration constants, linearity; special methods of solution; integration factors; variation of parameters; Euler, higher order linear equations; physical origins of ordinary differential equations and linear systems; linearization of engineering problems; stability of engineering systems.

5.075G Computational Methods in Mechanical Engineering 1 — C2

Prerequisites: 5.072 (Computing strand) or 5.0721 and 5.073 (Numerical analysis strand) or equivalent.

Computer programming and numerical analysis review. Solution of transcendental equations. Systems of equations. Calculus of finite differences. Numerical integration, differentiation. Numerical solution of ordinary differential equations.

5.076G Computational Methods in Mechanical Engineering 2 — C2

Prerequisites: 5.072 (Computing strand) or 5.0721 and 5.073 (Numerical analysis strand) or equivalent.

Partial differential equations: finite differences and finite elements. Mathematical formulation of physical problems in mechanical engineering and their solution.

5.086G Digital Logic Fundamentals for Mechanical Engineers — C3

Excluded: 6.021E, 6.631 and equivalent.

Discrete logic elements; assembly design; misoriented design; support devices; microprocessor units.

5.087G Microprocessor Fundamentals for Mechanical Engineers — C3

Prerequisite: 5.086G or equivalent. Excluded: 6.0318, 6.432, 6.613, 6.060G, 6.433G, 6.651G and equivalent.

Microprocessor chips; system design; memory; past design; programming; applications.

5.088G Industrial Applications of Microprocessors — C3

Prerequisite: 5.087G or equivalent. Excluded: 6.432, 6.433G, 6.651G and equivalent.

Coding and programming. Transducer selection. Information transfer. Data storage. Power output device control. Application to industrial automation and control. Laboratory complement to lectures.

5.089G Elements of Industrial Automation — C3

Co-requisite: 5.086G or equivalent.

An introductory overview of the elements of Industrial Automation systems and the factors governing their use in industry.

5.090G The Analysis and Use of Integrated CAD/CAM Systems — C3

Prerequisite: 5.089G.

Economic background to the use of CAD/CAM systems. Elements in systems for use with machining centres, lathes and sheet metal machinery. Data input techniques. Coordinate handling. Machine specific post processors. Data verification and output integrity analysis. Techniques for interfacing machine tools with computers. Restrictions imposed by requirements for real time control. Integration with accounting and cost analysis systems. Choice of computer. Factors in CAD/CAM system selection.

5.151G Refrigeration and Air Conditioning Design 1 **C3**

Prerequisite: 5.624 or equivalent.

5.152G Refrigeration and Air Conditioning Design 2 **C3**

Prerequisite: 5.151G or equivalent.

Design of refrigeration equipment compressors; throttling devices; condensers; evaporators. Cooling towers: evaporative condensers; air conditioning coils. Generators and absorbers for absorption systems. Piping systems. Air ducts. Steam raising and water heating equipment. Calculation of transient heating and cooling loads. Air conditioning systems. Load analysis and system capability.

5.307G Dynamics 1 **C3**

Excluded: 5.304G and equivalent.

5.308G Dynamics 2 **C3**

Prerequisite: 5.307G or equivalent. Excluded: 5.305G and equivalent.

Space kinematics and kinetics of rigid bodies. Inertia matrix. Ellipsoid of inertia. Euler's equations of motion. General motion of roto-symmetrical bodies. Eulerian angles. Co-ordinate transformations. Momentum and Energy of rigid bodies in general motion. Generalized co-ordinates. Stability. Lagrange's equations. Lagrange multipliers. Vibratory systems. State equations, analytical and iterative solutions for the state variables. Lagrange's equations for impulsive forces. Hamilton's equations.

5.317G Industrial Robotics **C3**

Prerequisite: 5.086G or equivalent.

Applications survey. System structure, hardware, software, handling. Linkage kinematic structure; power transmission. Linkage structural design. Actuator choice. Interface hardware. Feedback. Function programming philosophies. Control algorithms. Problem specification; solution preparation. Writing, storage, implementation of computer algorithms.

5.318G Advanced Mechanism Analysis and Synthesis 1 **C3**

Excluded: 5.315G and equivalent.

5.319G Advanced Mechanism Analysis and Synthesis 2 **C3**

Excluded: 5.316G and equivalent.

A selection of topics from *Planar mechanisms:* kinematic analysis of complex mechanisms; kinetic analysis; kinematic geometry; precision position synthesis. *Cams:* basic and common curves; equations of motion; development of profile; determination of system geometry and mechanical properties; noise, wear, backlash and manufacture. *Spatial linkages:* structural analysis; closure equations; screw system algebra; special configurations.

5.328G Control and Modelling of Mechanical Systems 1 **C3**

5.329G Control and Modelling of Mechanical Systems 2 **C3**

Prerequisite: 5.328G or equivalent.

Development of modelling techniques using both digital and analogue computation, with special emphasis on the representation of non-linearities. Typical examples of mechanical systems.

5.335G Vibrations **C2**

Comparison of time, frequency, transform domain techniques for linear systems analysis. Application of Lagrange's equation and matrix methods in free, forced multi degree-of-freedom systems. Modal analysis; numerical methods. Beam shaft vibrations; approximate methods. Self-excited vibrations, stability. Random vibrations. Laboratory work on vibration measurement, testing.

5.336G Random Vibrations **C2**

Prerequisite: 5.331 or 5.333 or equivalent.

Probability, vibration theory review, linear mechanical system response to random vibrations. Statistical characteristics: autocorrelation, spectral density, convolution, narrow band processing, consistency, applications.

5.345G Analogue Control Systems **C3**

Prerequisite: 5.324 or 5.344 or equivalent. Excluded: 5.321G and equivalent.

Pneumatic and electronic systems for control. Analysis of continuous action controllers. Control system simulation. Analytical methods for the determination of controller settings. Controller selection. Manual tuning and control system operation. Control valves. Characteristics and interaction of valves, pumps and piping. Actuator motor selection and function generation.

5.346G Non-Linear Control Systems **C3**

Prerequisite: 5.324 or 5.344 or equivalent. Excluded: 5.322G and equivalent.

Characteristics and methods for the analysis of non-linear control systems. Sinusoidal input describing functions for the common non-linearities. Limit cycle frequency and amplitude determination. Studies of systems in which the following non-linearities dominate the behaviour: backlash, coulomb friction, deadspace, hysteresis and saturation. Methods of compensation to avoid limit cycles. Analogue simulation of non-linear systems. Electronic systems for discontinuous control. On-off control with and without feedback stabilization. Single-speed floating control with and without feedback stabilization.

5.403G Experimental Stress Analysis **C3**

Excluded: 5.401G.

Strain gauging: practice, theory, instrumentation, data acquisition and processing, applications, load cell design. Photoelasticity: transmission and reflective. Brittle coatings. Dye penetrants. Practical laboratory classes throughout.

5.414G Finite Element Applications C3

Introduction to finite element and associated graphics packages. Principles of mesh design and validation. Specification of boundary conditions including use of symmetry. Estimation of the cost of solution. Interpretation of results. Assessment of the accuracy of the results. Convergence to the exact solution. Selection of applications from linear and non-linear elasticity — three dimensional solids, plates and shells, plasticity, buckling and post-buckling behaviour, thermal stresses, dynamics including natural and forced vibration.

5.415G Stress Analysis for Mechanical Engineering Design 1 C3

Prerequisite: 5.423 or equivalent. Excluded: 5.421G-5.424G and equivalent.

Plates, shells: primary, secondary and peak stresses, relations to strength. Pressure vessels. Current design philosophies.

5.416G Stress Analysis for Mechanical Engineering Design 2 C3

Prerequisite: 5.423 or equivalent. Excluded: 5.421G-5.424G and equivalent.

Topics selected from: Plastic collapse. Limit state design. Stress concentrations. Plate girder panel structures. Lightweight structures. Machine frames. High temperature components. Gears.

5.417G Mechanics of Fracture and Fatigue C3

Excluded: 5.428G and 5.429G or equivalent, 5.424.

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

5.601G Computational Fluid Dynamics C3

Prerequisite: 5.076G or equivalent.

Incompressible flow: primitive equations; stream function, vorticity equations. The conservative property. Stability analysis. Explicit, implicit methods. Upwind differences. SOR methods. Fourier series methods. Pressure, temperature solutions. Solving the primitive equations.

5.616G Internal Combustion Engines 1 C3

Prerequisite: 5.653 or equivalent. Co-requisite (for undergraduates): 5.643. Excluded: 5.615G and equivalent.

Thermodynamic cycles. Combustion, reaction kinetics. Real engine cycles. Chart, computer analysis. Spark ignition engines. Flame physics. Combustion chamber design. Charging, discharging; heat transfer; friction. Emissions, fuels, computer modelling: efficiency, performance, emissions. Testing, laboratory.

5.617G Internal Combustion Engines 2 C3

Prerequisite: 5.615G or 5.616G or equivalent.

Modifications, alternatives to SI engine: Stratified charge, rotary, orbital, turbo charged, two stroke. Compression ignition engine: combustion knock, chamber design, emissions. Gas turbines. Cycles, limitations, regeneration, combustion, emission. Axial, centrifugal compressors, turbines; matching. Aircraft, automotive, industrial types. Stirling engines: cycle analysis, design laboratory.

5.621G Gasdynamics 1 C2

Excluded: 5.653.

5.622G Gasdynamics 2 C2

Prerequisite: 5.653 or 5.621G or equivalent.

Kinematics, dynamics, thermodynamics, vorticity. Nozzle. Wind tunnel. Diffusers. Shock waves; steady, moving. Method of characteristics. Combustion. Real gas behaviour at high temperature. Hypersonic aerodynamics, free molecule flow, re-entry; high energy experimental methods.

5.631G Lubrication Theory and Design 1 C2

Excluded: 5.6342.

Hydrostatic lubrication, squeeze films, hydrodynamic lubrication, slider bearings, tilting pad thrust bearings, journal bearings, practical journal and thrust bearing design; air bearings; friction, wear; dry boundary lubrication; lubricant, bearing material selection; anti-friction bearings.

5.632G Lubrication Theory and Design 2 C2

Prerequisite: 5.6342 or 5.631G or equivalent.

Continuum equations of hydrodynamic lubrication. Journal bearing dynamics. Rolling contacts. Elastohydrodynamic lubrication. Grease lubrication. Plasto-elastohydrodynamic lubrication. Metal forming, cutting lubrication.

5.653G Acoustic Noise 1 C2

Excluded: 5.3541.

Acoustic waves, sources. Near, far fields. Vibrating surfaces. Transmission in gases, liquids, solids. Boundary reflection, refraction, transmission, scattering. Absorbing materials. Reverberant, anechoic environments, spaces, ducts. Resonators.

5.654G Acoustic Noise 2 C2

Excluded: 5.3542.

Noise measuring, instrumentation. Random signal analysis. Human response. Noise ratings, indices. Noise criteria. Assessment problems, control, isolation. Vibration control. Acoustic damping materials. Common noise source characteristics. Turbulent flows.

5.655G Energy Conservation and System Design C3

Examination of some existing systems, assessment of their energy losses and their improvement by tuning. Alternative energy sources and their availability, energy utilization and efficiency in various systems. Environmental aspects, assessment of emissions, means of improvement. Economically viable energy technology under present conditions. Expected trends in energy technology in the short and long term. A number of case studies.

5.716G Advanced Heat Transfer 1 C3

Prerequisite: 5.623 or equivalent. Excluded: 5.718G, 5.719G, 5.721G and equivalent.

Steady, one-dimensional conduction. Two- and three-dimensional conduction. Unsteady conduction in one or more dimensions. Temperature fields with heat sources. Non-homogenous bodies; variable material properties. Thermal radiation properties of materials, black bodies; characteristics of real solids, liquids and gases; radiation exchange between surfaces; radiation in an enclosure. Solar radiation. Characteristics of solar collector absorbers.

5.717G Advanced Heat Transfer 2 C3

Prerequisite: 5.623 or equivalent. Excluded: 5.712G, 5.713G and equivalent.

Fluid dynamics: boundary layer equations, transition, turbulence. Pipe flow. Isothermal two-phase flow. Forced convection. Free convection. Heat exchangers.

5.722G Solar Thermal Energy Design C3

Prerequisite: 5.721G or equivalent. Excluded: 5.720G and equivalent.

Characteristics of solar radiation and solar collectors. Collector efficiency evaluation and prediction of long term performance. System modelling, energy storage; computer simulation and modelling of performance and economic worth.

5.751G Refrigeration, Air Conditioning and Cryogenics 1 C2

Prerequisite: 5.624 or equivalent.

5.752G Refrigeration, Air Conditioning and Cryogenics 2 C2

Prerequisite: 5.751G or equivalent.

Thermodynamic principles, diagrams; properties of real fluids, refrigerants. Thermodynamics of change of phase; liquids and dilute solutions; mixtures of liquids; steady flow processes with binary mixtures; rectification of a binary mixture; absorption refrigeration; resorption refrigeration. The vapour compression cycle; multi-pressure systems; analysis of compressor performance; condensers, evaporators and expansion devices; properties of the ideal refrigerant; reversed cycles; analysis and performance characteristics of the complete cycle. Air-cycle, steam-jet refrigeration; application to air conditioning design; cooling towers, mixtures of gases and vapours; psychrometry, evaporative cooling of air; dehumidification of air. Thermoelectric cooling; Seebeck, Joulean, conduction, Peltier, Thomson effects; thermodynamic analysis; thermoelectric materials. Production of low temperatures; liquefaction and rectification of gases; magnetic cooling; application to research.

5.758G Refrigeration and Air Conditioning Applications C4

Industrial, commercial and domestic application of refrigeration and air conditioning. The science and technology of foods. Building design and construction. Engineering acoustics. Refrigeration technology. Law in relation to engineering. Ergonomics and biomechanics.

5.909G Project C9

5.912G Naval Hydrodynamics 1 C2

Prerequisite: 5.663 or 10.411A or equivalent.

5.913G Naval Hydrodynamics 2 C2

Prerequisite: 5.912G or equivalent.

Advanced treatment of topics selected from: ship waves and ship resistance; ship manoeuvrability; ship motion and seakeeping; hydrofoil and propeller theory; aero and hydrodynamics of surface effect machines.

5.918G Project Report C18

5.936G Thesis C36

Electrical Engineering and Computer Science

6.050G Occasional Elective — Digital Signal Processing S2 C3

Prerequisite: 6.042 or 6.341G or similar. Excluded: 6.150G (1980 version).

Advanced subject on the techniques and applications of digital signal processing which assumes students have had basic courses on discrete-time systems and signals (such as digital filters, z-transforms and discrete Fourier transforms) and elementary random processes. Application areas stressed are telecommunications, speech processing and seismic signal processing and possibly radar and sonar. Topics to be included are: interpolation and decimation of digital signals with applications in telecommunications (eg TDM/FDM transmultiplexers); linear prediction with autoregressive (AR) and moving average (MA) parameter estimation applied to spectrum estimation and speech analysis; least mean-square adaptive and predictive deconvolution (including Wiener and Kalman filtering), with applications in impulse response restoration and the removal of noise and echoes in communication systems and seismic signals; short-time Fourier analysis and synthesis and homomorphic signal processing for speech and seismic signals; two dimensional digital signal processing with applications in image de-blurring and data compression. Practical work includes computer assignments and the use of special purpose programmable hardware signal processors.

6.060G Microprocessor Systems S2 C3

Prerequisites: 6.021C attempted at an acceptable level and 6.021D, or 6.620 and 6.021E, or 6.631. Excluded: 6.0318, 6.613, 5.087G, 5.088G.

LSI technologies and devices. Microprocessor integrated circuits. Outline of system configurations. Microprocessor busses, control signals and timing. Programming models and instruction sets. Programming including addressing modes, arithmetic and I/O. Memory devices including RAM, ROM, EPROM. Input/output devices and support chips. Parallel and serial I/O devices. Direct memory access. Interrupt systems. Microcomputer system devices including cassette tape, floppy disk, keyboards, LED and video displays. System development software including monitors, PROM programmers, editors, assemblers and higher level languages. Development tools, logic state analyzers, emulators. The course will include laboratory involving both hardware and programming experience.

6.073G Precise Electrical Measurements C3

Prerequisites: 6.0311, 6.0313, 6.041 or equivalent.

An advanced course primarily devoted to the special problems of precision measurements at DC and audio frequencies. Establishment of electrical standards.

6.074G Superconductivity C3

The theory of superconductivity and its application. Includes loss mechanisms, ac losses, flux jumps, superconducting materials, applications to electrical apparatus.

6.150G Communications Elective — Applied Optoelectronics S2 C3

Wave and particle nature of light. Photon emission and absorption. Characteristics of optoelectronic devices: photoconductive cells, solar cells, LED, PIN and avalanche photodetectors. Principles and applications of lasers. Electro-optic and acousto-optic modulation of laser light. Fundamentals of optical image formation. Spatial filtering. Design and implementation of optical fibre system. The lectures are supplemented by experimental work in optical data processing and design aspects associated with optoelectronic devices.

6.164G Microwave Antenna Theory and Applications S2 C3

Co-requisite: 6.167G or similar.

An advanced level treatment of antenna design and analysis, including reflector antennas and phased arrays and their applications. Includes: A review of basic theory, analysis and synthesis of phased arrays. Reflector antennas; single and dual reflector systems. Tolerance theory. New concepts of primary radiator design. Optimization techniques. Primary feeds for monopulse radar. Antennas for navigation aids. Adaptive phased arrays and their application to radar, basic adaptive array algorithm, acquisition techniques and implementation.

6.167G Propagation and Transmission of Electromagnetic Waves S1 C3

Required as a prerequisite or co-requisite for 6.164G Microwave Antenna Theory and Applications, 6.169G Microwave Circuits: Theory and Techniques, 6.170G Microwave Electronics, 6.337G Sound Broadcast Systems, 6.338G Television Systems and 6.349G Radar and Navigation Aids.

Fundamental concepts and analytical techniques of guided wave propagation and antennas. Waveguide theory; rectangular and circular waveguides, optical fibres and microstrip transmission lines. Numerical techniques; finite difference and finite element methods. Tropospheric and ionospheric propagation. Fading. Basic antenna theory. Aperture antennas. Phased arrays.

6.169G Microwave Circuits: Theory and Techniques S2 C3

Co-requisite: 6.167G or similar.

Properties of microstrip transmission lines and the theory and design of microwave integrated circuit components and systems. Includes: microwave measurement techniques, waveguide components and applications.

6.170G Microwave Electronics S2 C3

Co-requisite: 6.167G, 6.340G or similar.

The principles and applications of solid state and electron tube microwave devices. Includes: Gunn, IMPATT, TRAPATT and PIN diodes; mixers and detectors; space charge waves; travelling wave tubes, klystrons and crossed-field devices.

6.221G High Voltage Technology C3

Prerequisite: 6.202 or equivalent. Excluded: 6.222.

Introduction to the technology involved in the design and testing of high voltage power system equipment.

6.224G Partial Discharges in Electrical Insulation C3

Prerequisite: 6.202 or 6.222 or equivalent.

Many aspects of partial discharge phenomena and their effect on electrical insulation. The physical processes involved in partial discharges plus the interpretation of results from measurements on simple and complex apparatus, such as power cables, power capacitors, rotating machines and transformers. Techniques studied include digital based systems with particular emphasis being given to practical applications, in order to relate theoretical concepts to measurements which are subject to laboratory or on-site limitations.

6.227G Insulation Performance in Electrical Plant C3

Prerequisite: 6.202 or 6.222 or equivalent.

Selection from: design test requirements. Forms of high voltage works test: alternating, impulse, switching surge and direct. Non destructive tests: dielectric loss angle, dispersion, partial discharge and insulation resistance. Methods of determining material condition: moisture content, gas in oil, impurities, electron microscopy including determination of aging and long life. Commissioning and site tests.

Demonstrations and projects to support the lecture material.

6.228G Power System Equipment C3

Prerequisite: 6.202 or equivalent.

Includes study of the operating characteristics and major design features of the items comprising a power system, including alternators, power transformers, voltage and current instrumentation equipment, oil and gas insulated circuit breakers, isolators, overhead lines and components. Lighting arrestors and protection for lines and substations. Power and the line coupling capacitors, bus bars, connectors, cables and bushings. Line carrier systems.

6.229G Fields and Materials C3

General description of the inter-relationship between the different types of fields (electric, magnetic and thermal) and materials when used in various areas of electric power engineering. Topics include: a general coverage of dielectric, conducting, magnetic and thermal materials; solution of Poisson's Laplace's and Fourier's equations for simple geometries and calculation of electric, magnetic and thermal fields, including boundary effects; a selection of typical applications, including earthing, thermal rating, electric heating, contact effects, laser action, surface electron emission, etc; a brief outline of some measurement techniques applicable to the above.

6.234G Power System Protection C3

Prerequisite: 6.202 or equivalent: credit level or higher.

The theory and application of protective devices and systems, related to the protection of transmission lines, transformers, bus bars and generators.

6.242G Power System Analysis C3

Prerequisite: 6.202 or equivalent. Excluded: 6.203.

Emphasis on interconnected system operation, performance and control. Digital computer techniques for power system analysis. Review of topics in numerical analysis, simultaneous linear and non-linear equations, numerical integration, sparsity programmming techniques. Load-flow. Short-circuit analysis. Steady-state and transient stability analysis. Harmonics.

6.250G Power Elective 1 C3

As for 6.550G Solid State Electronics Elective.

6.251G Power Elective 2 C3

As for 6.550G Solid State Electronics Elective.

6.256G Underground Systems C3

Prerequisite: 6.202 or equivalent.

A specialized course relating to developments and contemporary practices in underground systems for the transmission of electrical energy. The thermal and electrical properties, rating and economics of cable systems and their accessories for a range of voltages from the reticulation level through to transmission voltage levels.

6.257G Electric Power Distribution Systems C3

Prerequisite: 6.203 or equivalent.

The engineering problems or distribution systems including industrial power systems, stressing the electrical distribution system as an entity. Distribution system planning. Overall design criteria. Co-ordination of thermal ratings. Protection of distribution network: cables and overhead lines. Design and performance of individual plant items. Particular problems of urban and rural distribution systems. Demonstrations and project work.

6.336G Digital Communication Networks S2 C3

Prerequisites: 6.343G or similar. Some familiarity with probability, random processes, queueing theory and Markov processes is an advantage.

Provides an up-to-date coverage of key techniques and their underlying principles in two important areas of digital communications, namely: *Computer Communication Networks* including capacity assignment, time delay versus cost trade-offs, information flow control, queueing theory, concentration and buffering in store-and-forward networks, message and packet switching algorithms, protocols, routing and network topology. *Random Access Techniques* including time-division multiple access, ALOHA systems, spread spectrum systems, direct sequence systems, interference rejection, jamming margin, error correction techniques using block and convolutional codes.

6.337G Sound Broadcast Systems C3

Prerequisites: 6.167G, 6.341G or similar.

Theory and practice of sound broadcasting systems. *Topics: Specifications:* coverage, bandwidth, power. *AM radio:* studio equipment, sound equipment, medium and shortwave systems, transmitters, antennas. *FM radio:* stereotransmission, studio equipment, transmitters, antennas. *Recording equipment:* links, etc. *Distortion:* distortion in recorders, distortion and noise in various parts of the transmission path.

6.338G Television Systems C3

Prerequisites: 6.167G, 6.341G or similar.

Theory and practice of broadcast television systems. *Topics:* Representation of colour and luminance. Australian standards: synchronization, colour coding, reasons for choice. Other systems. Studio equipment: cameras, video recorders, etc, transmitters. Propagation problems, distortion. Receivers, Teletext.

6.339G Electroacoustics C6

Aspects of acoustics which are relevant to sound engineering, includes: scalar wave equation, plane and spherical waves, plane piston as a sound source, analysis of mechanical and acoustical lumped systems; loudspeaker and microphone types, practical aspects; room acoustics; sound recording; the ear, loudness and annoyance; underwater sound; introduction to sound in solids.

6.340G Communication Electronics — S1 C3

Prerequisite or co-requisite for 6.170G Microwave Electronics and 6.345G Analogue and Digital Filters.

Modern electronics as used in communication systems. *Includes:* analogue and digital integrated circuits (including ADCs, DACs PLLs, VCOs, multipliers, etc, and a survey of the main digital IC families); high-frequency and noise performance of active and passive circuits, particularly those using transistors; transistor ratings; microwave ICs; microstrip, thick film, and thin film circuits, CCDs and SEW devices, and their use in signal processing; introduction to active and other filters; factors involved in the design of large electronic systems.

6.341G Signal Analysis — S1 C3

Excluded: 6.042, 6.484G, 32.621G or similar.

Prerequisite or co-requisite for 6.337G Sound Broadcast Systems, 6.338G Television Systems, 6.343G Digital and Analogue Communications, 6.344G Communication Theory, 6.345G Analogue and Digital Filters and 6.349G Radar and Navigation Aids.

The fundamental aspects of the analysis and processing of digital and analogue signals, with emphasis on random signals and noise. Includes: Generalized Fourier analysis; convolution, correlation, energy and power density spectra. Hilbert transforms; analytic signals and signals in systems. Sampling and digital processing of analogue signals, including digital filtering. The discrete Fourier transform (DFT) and the use of fast Fourier transform (FFT) algorithms. Random processes, the transmission of signals and noise through linear systems and non-linear devices. Poisson and Gaussian random processes. Estimation and measurement of power density spectra.

6.343G Digital and Analogue Communications — S1 C3

Co-requisite: 6.042 or 6.341G or similar. Excluded: 6.323 or similar.

Prerequisite or co-requisite for 6.347G Digital Communications and 6.348G Optical Communications.

Fundamentals of modern telecommunications systems, including theoretical and practical aspects of: linear and non-linear analogue modulation (AM, SSB, FM, etc), digital signal transmission, pulse code modulation, computer communication, effects of noise in analogue and digital systems, error control, multichannel systems (FDM, TDM, etc), synchronization, relay systems, optimum transmitters and receivers.

6.344G Communication Theory — C3

Prerequisite: 6.341G or similar.

An advanced subject, mainly for potential research workers, concerned with the theoretical basis of information transmission and the design of optimum analogue and digital communication systems. *Topics:* Information theory of discrete and continuous systems, channel capacity, rate distortion theory and fidelity criteria. Information theory for two-way communication. Optimum detection and estimation of analogue and digital signals using maximum likelihood (ML), maximum a posteriori (MAP), minimum mean-square error (MMSE) etc, criteria. Includes Wiener and Kalman filtering, and optimum detection and estimation of linearly and non-linearly modulated, analogue or digital, signals.

6.345G Analogue and Digital Filters — S2 C3

Co-requisites: 6.340G and 6.341G or similar.

Theory and practice of modern filter design, particularly the design of active and digital filters. Includes: overview of modern filter methods, the approximation problems for analogue and digital filters, active filters and digital filters. In addition: classical LC filters, sensitivity and parasitics, equalizer design, adaptive and/or non-linear equalization, mechanical filters, other signal processing techniques.

6.347G Digital Communications — S2 C3

Prerequisite: 6.343G or similar.

Advanced and unified treatment of digital transmission systems. *Principal topics are: Baseband ASK digital communication Systems* including inter-symbol interference, eye patterns, power spectral density, probability of error estimates and bounds, Nyquist criterion partial response signals (eg simple and modified duobinary). *Digital Modulation* including various types of shift keying modulation such as amplitude, amplitude and phase, offset amplitude and phase, phase, frequency and minimum shift keying (ASK, APSK, OAPSK, PSK, FSK and MSK), power spectral density, probability of error, signal constellations and system comparison. *Line Coding* including linear codes, alphabetic codes, non-alphabetic codes and their comparison. *Equalization* including linear, non-linear, adaptive and automatic equalization and Viterbi decoders.

6.348G Optical Communications — S1 C3

Co-requisites: 6.167G, 6.343G or similar.

Optical communications, with emphasis on optical fibre communication. *Includes:* theory of optical fibre propagation, cable technology, LED and laser sources, optical detectors and receiver design, measurements on optical fibres, system performance, wide-band systems and future systems, applications to power and military systems.

6.349G Radar and Navigation Aids — S2 C3

Co-requisites: 6.167G and 6.341G or similar.

Theory, performance and applications of various electronic location and navigation systems. Includes: review of basic radar theory, CW radar, pulse radar, pulse-Doppler radar, tracking radar, detection of radar signals in noise, error analysis, clutter suppression, multiple-target detection, theory of high-resolution radar, synthetic aperture radar, terrain-avoidance and terrain-following radar; aircraft landing systems; DME; radio ranges; hyperbolic navigation systems, Doppler navigation, satellite navigation.

6.433G Applied Microprocessor Design — S2 C3

Prerequisite: 6.060G.

Aims to familiarize the systems designer with the architecture and applications of the rapidly expanding family of microprocessor hardware support devices for dedicated control functions. *Topics include:* review and comparison of bus protocols of common systems; architecture, programming and applications of specialized system support devices and peripheral control chips; single chip microprocessors, architecture and applications to dedicated control tasks. *Laboratory work* includes individual design projects involving typical systems application of these devices.

6.452G Feedback Control 1 C3

Excluded: 6.412.

An intensive series of lectures and tutorials for upgrading at graduate level those students who are deficient in the basics of control. Material covered includes both time and frequency domain approaches to the design of control systems for linear, continuous single input/single output plants. *Topics include:* Nyquist stability theory; root locus diagrams; Nichols charts; state feedback and observer design. Computer-aided design techniques are applied where appropriate.

6.453G Computer Methods of Optimization C3

Use of digital, analog and hybrid computers for the solution of optimization problems in engineering. Includes: constrained and unconstrained minimization, review of search techniques, optimal control and the two point boundary value problem, linear quadratic problems and minimum time schemes. All methods are implemented on the computer.

6.455G Systems Identification and Modelling S1 C3

Develops the basic techniques used in System Identification and Modelling. *Topics include:* representation of static and dynamic systems; parameter estimation; Maximum Likelihood Estimation methods, nonparametric methods; time series; spectral methods; pseudo random noise methods; recursive methods, least squares; analysis of residuals; accuracy, goodness of fit; adaptive systems (on-line estimation).

6.456G General Concepts in Formal System Theories C3

Provides fundamental concepts common to many formal abstract system theories reflecting different aspects of the physical systems, which are their bases. Input-output, state transition, fuzzy, axiomatic-hierarchical and evolutionary representants will be reviewed with discussion based on differential and discrete models, and some form of pulsed automata. Basic concepts presented include the state properties and basis functions for linear systems; equivalence and reduction, structure, decomposition and interconnection; complexity; accessibility of states and stability considerations.

6.457G Cybernetic Engineering S1 C3

The fundamentals of cybernetic engineering, the genesis of cybernetics, machines modelled on life and the evolution to present day robots. Includes: biological information transmission (biochemical coding and control, genetic and neural), pattern recognition learning systems and perceptrons, sub-systems of the human brain, and 'functional' descriptions for a 'Cybernetic Brain', an introduction to industrial manipulators and third generation robots; self-organizing control for manipulators and robots and the social consequences of flexible automation with industrial robots.

6.458G Decision and Syntactic Systems for Digital Pattern Recognition S2 C3

Concepts and techniques in decision-theoretic pattern recognition systems with an in-depth study of both non-parametric and parametric methods. Includes: pattern, feature and classification spaces, feature selection, linear discriminant functions and training algorithms; piecewise linear, discriminant functions; decision rules; the Bayes framework, approximation of probability densities; clustering and dimensionality reduction. Structural pattern recognition, including such topics as formal linguistics, primitives, grammar and syntax analysis as a recognition procedure.

6.459G Control Computing C3

Prerequisites: 6.412, 6.021D.

Review of fundamental principles of digital and analog computation with special reference to the solution of engineering and control problems. *Topics include:* small computer systems architecture; process control interfacing techniques; machine language programming; operation of hybrid computers and their applications.

6.460G Real Time Computing and Simulation C3

Simulation of industrial processes by the use of real time modelling techniques is now an acceptable method for the study of complex industrial plant, eg, fossil-fired boiler-turbines; 747 aircraft; nuclear reactors. The fundamentals of real time computing, with examples carried out on an EAI 2000 — PDP-11 computing system. Analog, digital and hybrid simulation techniques as applied to the solution of lumped and distributed parameter systems.

6.464G Digital Estimation, Prediction and Control C3

Prerequisites: 6.452G, 6.472G.

Topics selected from: optimal linear filtering, recursive filters, Kalman filters; optimal smoothing algorithms; and least squares estimation. The real time digital implementation of the algorithms is emphasized in the laboratory using both a PDP11/34 minicomputer and Motorola 6800 microcomputer. Specific applications relate to on-line digital control and signal processing.

6.466G Computer-Aided Design of Multivariable Control Systems S2 C3

Many control problems result from interaction between key variables and can only be solved by a multivariable analysis. This can be approached in the time domain, eg the linear quadratic regulator, or the frequency domain, eg the inverse Nyquist array. Methods available, their limitations and strengths, and integration and comparison of the time and frequency approach. Laboratory work using interactive programs on the Department's Varian computer. *Topics include:* time domain methods, pole shifting, state decoupling, optimal control; frequency domain methods, inverse and direct Nyquist methods, characteristic locus.

6.467G Digital Image Processing Systems, Scene Analysis and Machine Vision S1 C3

The fundamentals of image processing including such topics as visual perception and the image model; uniform and non-uniform sampling and quantization; image transforms; image enhancement, sharpening and smoothing; image restoration and least squares filtering; image encoding, mapping, quantizing and encoding; image segmentation and description, grammars, languages and similarity. Material oriented towards scene analysis and world models for industrial robots including scenes; labelling; shadows; shape information; structural descriptions and representing knowledge; computer vision for robots.

6.468G Computer Display Systems and Interactive Instrumentation C3

Prerequisite: 6.060G.

Man-machine-process communication and control, and associated microprocessor based instrumentation. Review of appropriate analog and digital technology. Microcomputer hardware and programming for interactive communication using both machine and high-level languages. Display devices, operating principles and performance limitations. Hardware and software techniques for computer-generation and processing of pictures. Colour and movement. Interactive design and graphics creation. The geometry of transformations and projections. Light pens and other input devices. Non-visual communications including speech input-output.

6.470G Advanced Topics in Control — Robotics, Automation and Productivity Technology S2 C3

Principles of Robotics relevant to future trends in automating the manufacturing process. Such aspects as arm configurations, dynamics and control with relevant sensing methods; image understanding for inspection, assembly and control together with trends in artificial intelligence for Robotics are discussed.

6.471G Systems and Control Elective — Compartmental System Analysis S2 C3

Compartmental system analysis, an important branch of system theory and design, serves to unify modelling and analysis in many diverse fields. It has wide application in pharmacokinetic, metabolic, ecosystem and chemical kinetic modelling, and in the future will be applied increasingly to engineering systems. *Topics include:* classes of compartmental structure; fundamental properties; rate processes; inferred parameters; input-dependent kinetics; optimal input design; algorithms for indentification and control.

6.472G Feedback Control 2 C3

Prerequisite: 6.452G. Excluded: 6.412, 6.413.

Models of Linear and Nonlinear Systems including lumped and distributed systems, continuous and sampled data systems. Fitting parameters to linear models by batch and recursive methods. State estimation. Systems with time delays and types of nonlinearities. Introduction to digital process control including algorithms for 3-term controllers, dead beat response systems and optimal control.

6.481G Introductory Physiology for Engineers S1 C3

Excluded: 6.402.

An introduction to biophysics and physiology for Engineers. Cells, tissues and organ systems with emphasis on their functional and regulatory characteristics and their interaction. An introduction to computer models of physiological control systems demonstrating their value in understanding the dynamics of complex neural, hormonal and circulatory responses to changes in homeostasis.

6.484G Biological Signal Analysis S1 C3

Excluded: 6.341G.

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

6.550G Solid State Electronics Elective C3

This syllabus changes from one occasion to the next, allowing presentation of a modern topic at graduate level, particularly by visiting academics of eminence.

6.573G Advanced Semiconductor Devices C3

Theory and characteristics of semiconductor devices, notably bipolar transistors, field effect transistors, and thyristors. The course discards many of the simplifications and generalizations made in the undergraduate treatment of transistors.

6.575G Integrated Circuit Technology C3

Prerequisite: 6.512 or 6.522 or equivalent.

Fabrication processes for MOS amd bipolar integrated circuits. Maskmaking, photolithography, oxidation, diffusion, ion implantation, selective oxidation, plasma processing, silicon deposition, conductor systems and contacts. Advanced technologies. Packaging methods, including hybrid technology.

6.576G Reliability Engineering C3

Prerequisite: 10.361 or equivalent. Excluded: 6.044.

Principles and applications of the reliability engineering concept, with equal emphasis on design analysis, developmental engineering, calculation and prediction of reliability and associated parameters, quality control, failure mechanisms, reliability testing, economic basis of reliability and on reliability improvement techniques. Applicable to both electronic and non-electronic systems.

6.577G Integrated Circuit Design C3

Prerequisite: 6.575G (preferred) or 6.0316.

May be taken concurrently with 6.650G Computer Science Elective — VLSI System Design.

An advanced treatment of the design of integrated circuits with emphasis on the relationships between technology, device characteristics and circuit design. Includes properties and modelling of bipolar and MOS circuit components, circuit analysis and simulation, layout rules, analog functions such as operational and power amplifiers; multipliers, D/A and A/D converters. Digital circuits include gates, compound functions, RAM, ROM, speed and power analysis. Economics and yield analysis for MSI, LSI and VLSI devices.

6.578G Solar Energy Conversion C3

World and Australian energy resources. Solar energy and the environment. Characteristics of received solar radiation. Thermal conversion (including thermoelectric devices). Selectively absorbing surfaces. Biological methods of conversion. Fundamentals of photovoltaic generation. Present and future applications of photovoltaic cells. Solar energy storage, and system considerations. Solar energy: research for the future.

6.579G Solar Cells — Operating Principles, Technology, and System Applications C3

Harnessing of sunlight by using solar cells to convert it directly to electricity. The properties of sunlight and of the semiconductors used in solar cells are reviewed and their interaction described. Factors important in the design of solar cells and the current technology used to produce cells. Likely future developments in this technology. System applications ranging from systems which are currently viable economically to residential and central power systems which may be a possibility for the future.

6.580G Image Analysis in Remote Sensing C3

Prerequisite: 10.361 or similar.

Techniques for extracting information from remotely sensed data with particular emphasis on satellite imagery. Topics taken from: nature and characteristics of earth resources and related satellites; satellite sensors and data formats; image enhancement techniques; image classification methods, including clustering, classification and feature selection; image classification methodologies; new horizons in remote sensing image analysis.

6.587G Computer Techniques in Remote Sensing Image Analysis C3

Prerequisite: 6.580G or similar.

A detailed treatment of computer methods for implementing analytical techniques used with remotely sensed data. *Topics include:* software requirements for image enhancement and analysis; structure and capabilities of the software packages LARSYS, ORSER, BICEP, LASP; implementation of classification methodologies, introduction to image processing hardware and associated operating systems; interactive image processing.

6.650G Computer Science Elective — VLSI System Design C3

Prerequisites: 6.021E, 6.631, 6.0313 or similar. Excluded: 6.607A.

Introduction to the design and implementation of very large scale integrated systems, using NMOS technology. Basic information about integrated devices, circuits, digital subsystems and system architecture. Design procedures, including structured design methodology, symbolic layout, use of scalable design rules, delay time estimates. Fabrication procedures and computer aided design. Scaling effects. A design project in LSI is an integral part of this course. Selected projects are fabricated and returned to students for testing and bonding.

6.651G Digital Electronics C3

Prerequisite: 6.021E and 6.0313, or 6.631.

Digital circuits and principles, sub-system organization, microprocessors, memory technology, interface design, integrated circuit technologies and characteristics.

6.654G Digital Systems C3

Prerequisite: 6.021E. Excluded: 6.612.

Computer architecture, implementation and realization. Use of hardware description languages for the analysis, design and specification of arithmetric units, storage and control Microprogramming techniques.

6.655G Computer Organization and Architecture C3

Prerequisite: 6.0318 or 6.613.

Basic principles of computer architecture. A comparative study of the architectural features of a number of significant computer systems.

6.656G Software Systems A C3

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded: 6.643, 6.602D, 6.672.

A theoretical and practical basis for subject matter within the following areas: compiler organization: data structures, table organization, list structures, (trees, stacks, etc), lexical analysis, syntax analysis, code generation, code optimization. Portability: solutions to the problems of moving software systems between different mechanics. Compiler compilers: translator writing systems designed to provide facilities to aid the compiler writer.

6.657G Software Systems B C3

Prerequisite: 6.631 and 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for these subjects). Excluded: 6.632, 6.602B, 6.672.

Overview of operating systems, sequential processes, concurrent processes, processor management, store management, scheduling algorithms, resource protection, data communication case studies.

6.659G Data Bases and Networks C3

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded: 6.622, 6.633, 6.652, 14.607, 14.608.

Data management, compression techniques, redundancy coding; indexing; hashing encryption and decryption. Data base management systems; data description languages; data manipulation languages; integrity and recovery. The relational view of data. Computer networks; digital data transmission; communication protocols; circuit switching; packet switching; packet routing, network performance. Current international standards and practice. Distributed data bases.

6.660G Design and Analysis of Algorithms C3

Prerequisites: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded: 6.642.

Techniques for the design and performance analysis of algorithms for a number of classes of problems. Analysis of algorithms: order notation, recurrence equations, worst case and expected order statistics. Design of efficient algorithms: recursion, divide and conquer, balancing; backtracking algorithms, branch and bound, dynamic programming; set manipulation problems; fast search algorithms, balanced optimal and multiway trees; graph representations and algorithms; pattern matching algorithms. NP — complete problems. Design and specification of programs: modularization, interface design, introduction to formal specification techniques.

6.661G Business Information Systems C3

Prerequisites: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 14.501. Excluded: 6.647, 14.602, 14.603, 14.605.

Accounting concepts and terminology. Auditing, internal controls. Systems Analysis. Flowcharting. Decision tables. Models of business information systems. System design. Feasibility studies, presentation of designs, implementation testing. The COBOL programming language. Data files: sequential, random, index sequential, inverted. File updating. Data bases, integrated information systems.

6.662G Computing Practice C3

Prerequisite: 6.641 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject). Excluded 6.649. Corequisite: 6.659G or 6.661G or 6.656G.

For students majoring in Computer Science who seek a programming career in government or commercial industry. Topics, related to current computing practice include: comparative study of computer hardware in current popular use: comparative study of the 'popular' programming languages, eg COBOL, RPG, BASIC, FORTRAN, PL/1, APL. Job control languages. Data Preparation procedures. Keyboard entry. Verification. Word processing; report preparation; documentation. Social implications of computing. Professional responsibilities and ethics. Project management, software engineering; psychology of computer programming.

6.909G Project C9

6.918G Project Report C18

6.936G Thesis C36

Servicing Subject

These are subjects taught within courses offered by other faculties.

6.680G Files and Database Systems

File structures, database management systems and file interrogation systems in a text processing or bibliographical environment. Topics include: relations, their mapping and normalization; access methods; data organization; independence, integrity and security; CODASYL databases, relational databases and query languages.

Civil Engineering

8.401G Human Factors in Transport SS C3

Human capabilities, ergonomic principles, attitudes to new concepts, planning, the law; application to transport planning, design and implementation. The human as a processor of information, influence on design of transport facilities particularly information displays, signals signs and lighting.

8.402G Transport, Environment, Community F C6

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity: government, bureaucracy and public involvement in transport policy and environment impact statements.

8.403G Theory of Land Use/Transport Interaction S1 C3

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state (functional behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional, national).

8.404G Local Area Transport Planning S1 C3

Application of theoretical methods to local area planning. Local government planning and engineering: pedestrian planning, frontage land use problems, analysis of residential areas, industrial estates, shopping centres and recreational facilities, accessibility studies, environmental studies, parking studies.

8.405G Urban Transport Planning Practice SS C3

Analytical techniques for urban land use, transport planning practice. Planning methodology: traffic generation, trip distribution, modal-choice, traffic assignment, evaluation. Land use forecasting: calibration and verification of behavioural models, application of mathematical programming models, case studies, public transport problems.

8.406G Regional Transport Planning S2 C3

The role of transport in economic and social development in regions including Third World countries; historical and contemporary analysis. Analytical techniques for regional planning. Planning practice, feasibility studies, evaluation methods. Case studies.

8.407G Transport System Design (Non-Urban) S1 C3

Process of location of road, railway and airport facilities. Data collection alternative routes, public discussion, methods, techniques, aids, plans and diagrams produced. Geometric form: differences between road, railway and airport carriageway layout. Optical guidance, design models, landscape, provision for surface-water signposting, fencing and posts.

8.408G Transport System Design (Urban) **S2 C3**

Types of urban transport facilities. Distributors, streets, bicycle routes, walk-oriented areas, bus lanes and rapid transit lanes, stops and change terminals, noise control. Minimum geometric form; speed range controls, provision for surface water on urban roads, landscape. Design of intersections and parking areas.

8.409G Interchange Design **SS C3**

Central projection theory and application to alignment design; perspective drawing methods, introduction to aerial and terrestrial photogrammetry, photomaps and photomontage as applied to transport facilities. Speed change lanes, exit and entrance terminals, ramp types, ramp speeds and design. Interchange location and layout, provision for surface water, signposting. Computer use. Safety measures during maintenance.

8.410G Highway Engineering Practice Part 1 **S1 C3**

Highway systems and organization. Roles and interaction of public and statutory highway and transportation authorities and research organizations. Sources and administration of highway finance. Highway programming. Feasibility studies. Engineering investigation and planning of highways and interchanges. Factors affecting long-term performance of transport facilities. Definition of design parameters. Factors of safety.

8.411G Highway Engineering Practice Part 2 **S2 C3**

Selection, comparison and critical evaluation of design procedures. Roles of ICES and other computer-oriented engineering systems in highway planning, design and construction. Maintenance systems. Economic modelling, investment costs. Prediction of performance. Implementation and revision of design decisions. Optimal use of resources. Project management for roads and interchanges. Choice of construction techniques. Upgrading of existing facilities, stage construction.

8.412G Economics for Transportation Studies **S1 C3**

Introductory macro and micro economic theory. The pricing mechanism in transport and distinctive characteristics of transport demand and costs National income and social accounts with particular refeence to the transport sector. Economics of public enterprise. Cost-benefit analysis and modelling. Engineering economics (compound interest) and budget determination. Econometrics. Selected special problems in the economics of transport modes.

8.413G Transport Economics **S2 C3**

Cost and price analysis fo each of the transport modes (road, rail, air and sea). Welfare analysis and taxation theory with respect to transport. Economics of location, economics of land use models; regional trade model.

8.414G Transport Systems Part 1 **S1 C3**

Definition of basic traffic elements, zero flow travel time, capacity, impedance/flow relationship. Transport Networks. The determination of shortest path, maximum flow, in networks. The topological description of networks. System parameters, performance. Application of network analysis to existing road, rail and air transport systems.

8.415G Transport Systems Part 2 **S2 C3**

Historical introduction to transport systems and development of various transport modes, road (vehicles, pedestrians, cycles), conveyor, rail, sea and air. Analysis of the operational characteristics of vehicles in the transport modes of road, rail and air. Analysis of the requirements of the rights of way for each transport mode. Development of optimum criteria for the distribution of cargo and passenger traffic. Terminals and mode transfer facilities. Development of system operational models. Energy consideration, new systems.

8.416G Traffic Engineering **F C6**

Road Inventory; traffic measurements; flow, speed, origin-destination, accidents, road structure. Road capacity: controlled and uncontrolled intersections, highways and freeways. Signal systems. Traffic operations and control; arterial and network systems. Parking. Hazard analysis and safety improvement. Enforcement. Bus service operation.

8.417G Transport and Traffic Flow Theory **F C6**

Analysis of deterministic and stochastic models of the traffic stream. Topics covered include the following. Definition and measurement of traffic stream parameters. Space and time distribution of speed. Overtaking models and the moving-observer method. Fundamental diagram of traffic. Car-following theory. Headway and counting distributions. Introduction to queueing theory. Simulation techniques. Signalized and unsignalized intersections.

8.418G Statistics for Transport Studies Part 1 **S1 C3**

Data collection and processing. Probability, variates, sampling of values. Standard distributions, sampling distributions. Inference: point estimation, hypothesis testing and interval estimation; power, confidence, sample size. Regression. Generating functions. Sums of random variable. Distribution-free inferences.

8.419G Statistics for Transport Studies Part 2 **S2 C3**

Linear models. Analysis of variance and co-variance. Simple and multiple regression. Design of experiments, interpretation of results. Sample survey design and analysis.

8.420G Transport Engineering Elective **SS C3**

An occasional offering in a specialized Transport and Highways topic selected according to current demand and/or availability of a local or visiting specialist.

8.701G Economic Decision Making in Civil Engineering **C3**

Review of practical engineering decision-making problems and relevant techniques. Engineering economics, benefit/cost analysis, consideration of inflation and taxation in investment decisions, bidding, decision theory, microeconomic theory, objectives and criteria, multiple objective planning.

8.702G Network Methods in Civil Engineering **C3**

Graphs, flow-in networks, optimal paths, critical path schedule, resources levelling, simulation networks, stochastic networks, project management, further applications.

8.703G Optimization Techniques in Civil Engineering C3

Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.704G Stochastic Methods in Civil Engineering C3

Queueing, Markov processes, theory of storage, reliability, renewal, application, transportation and allocation.

8.705G System Modelling C3

The development of system models for specific problem areas and decision positions. Problem environment, goals, objectives, and definition established by field contact and team discussion, information flow requirements and the design of user-oriented decision processes. Class size is limited to selected students.

8.706G Experimental Methods in Engineering Research C3

Purposes of experimentation in engineering research. Design of experiments; factorial and other designs; replication. Analysis of experimental data: analysis of variance and covariance; special analysis; other statistical methods. Decision theory.

8.707G Numerical Methods in Civil Engineering C3

Numerical integration, iterative processes. Solution of linear equations, especially sparse and banded systems. Approximation of functions. Eigenvalue problems. Design of programs. Implementation using PASCAL. Comparison study of FORTRAN and PASCAL.

8.710G Advanced Topics in Optimization in Civil Engineering C3

Special studies in optimization in Civil Engineering design and construction to be offered from time to time by appropriate specialists.

8.714G Advanced Topics in System Modelling C3

Special studies in system modelling to be offered from time to time by appropriate specialists.

8.723G Construction Design C3

Design of field services and structures; compressed air services, cofferdams, ground anchors, floating plant, formwork and falsework, bridge centring, well-points and dewatering systems.

8.724G Construction Technology C3

A selection of topics from; drilling, blasting techniques, tunnelling, rock-bolting and other ground support, earth/rock transport, harbours, railways, dams, bridges, structural steelwork techniques, pipeline construction, foundation grouting, compressed air work.

8.725G Construction Accounting and Control C3

Engineering economic planning, control of labour, plant and materials. Insurances. Financial accounting. Project finance and taxation. Management accounting techniques and cost controls.

8.726G Construction Law and Professional Practice C3

Nature and sources of law, court procedures, interpretation of documents, evidence, technical opinions. Contract law. Company law. Arbitration. Duties of an engineer.

8.727G Construction Planning and Estimating C6

Project initiation and development, feasibility studies, planning and estimating procedures, contract administration; estimating cost of labour plant and materials, indirect cost and overheads, profit; construction administration. Preparation of cost estimate for a major civil engineering project.

8.728G Design of Construction Operations C6

Heavy equipment, labour intensive, and composite operations; spatial layout and material flow concepts; the modelling of operations at the micro, macro, and systems level; engineered estimates and productivity prediction models; analysis of construction operations by timelapse methods; field methods at foreman, superintendent, engineer, and project manager levels; field studies of specific construction operations.

8.731G Project Management C3

A problem-oriented approach to Project and Mission Management; the nature of engineering and construction projects; the project team; behavioural aspects of project management; the organization and management of project resources; short term field planning and management strategies.

8.732G Advanced Project Management Theory C3

A theoretical and formative appoach to Project and Mission Management; management strategies and project success evaluation techniques; organizational and behavioural aspects of the project team structure; behaviour norms and their impact on project team motivation; project management decision processes; case studies in project management.

8.748G Pavement Materials 1 C3

Properties and usage of soil and rock as pavement materials in road, rail or other construction work. Modification and evaluation of these properties; criteria for use and acceptance testing; variability and quality control; requirements of crushed rock for surfacing; use of non-standard materials in pavement; materials resources; in service conditions and their effect on materials performance.

8.749G Pavement Materials 2 C3

Properties and usage of bitumens, asphalts, tars and concrete as pavement materials in road, rail, airfield or other construction work. Rheology of bitumens; bituminous coating of aggregates and the optimization of bituminous mixtures; asphaltic concrete. Bituminous sealing practice and theory. Bituminous soil stabilization; concrete pavement mixtures, reinforcement and placement. Concrete-bitumen mixtures. Reinforcement materials for pavements. Bituminized membranes. Quality control and performance of bituminous and concrete pavement materials.

8.750G Pavement Design and Evaluation 1 C3

Pavement types for road, rail, airfield and other works; Stress distribution in pavements, theoretical and actual; sub-grade conditions and traffic loadings; design principles methods and criteria for flexible pavements; design principles, methods and criteria for rigid and semi-rigid pavements, including stabilized soil and multilayer pavements; design principles, methods and criteria for design of railtracks. Design of special-duty and temporary pavements.

8.751G Pavement Design and Evaluation 2 C3

Evaluation of pavement condition. Pavement instrumentation. Types of pavement distress, their origins and remedy. Roughness and skid resistance. Environmental influences and effects. Pavement maintenance for flexible and rigid pavements. Overlays. Special Maintenance requirements for airfields and railtracks. Maintenance scheduling. Systems design for rigid and flexible pavements for optimization of cost-benefit.

8.752G Terrain Engineering C6

Basic geology, geological processes and geomorphology as they affect the planning of engineering works and construction. Specific civil engineering applications for highways, water storages, buildings, civil and military transport operations, etc. Photo interpretation, ground surveying, terrain mapping, information storage and retrieval.

8.753G Soil Engineering C3

Soil pedology, fabric studies. Soil stabilization with cement, lime, bitumen and others. Grouting. Special techniques of piling. Soil anchors, slurry trench design. Freezing and thermal soil treatments. Vacuum and Electro osmotic dewatering. Advanced techniques for the in site measurement of soil properties. Variability of safety factors.

8.754G Applied Soil Mechanics C3

A detailed study of rigid and flexible retaining structures, and of slope stability using both traditional and recent analytical methods. Applications of plasticity theory, refined failure surface analysis and the finite element method.

8.755G Materials of Construction (Concrete Technology) 1 C3

Concrete as a structural material. Basic Structure; strength microcracking and failure mechanisms; significance of tests and relation to design requirements. Variability, target strength, code and special criteria for acceptance and rejection of concrete. Non-destructive testing. Accelerated curing and special high-strength concretes for column and prestressed construction. Recent developments in constituent materials, special cements and admixtures. Workability, mix design theories and practical applications.

8.758G Soil Mechanics C3

A critical review of the theories of real soil behaviour and their implications for the selection of soil parameters for use in engineering design. Examination of the actual stress-strain and shear strength behaviour of saturated and unsaturated soils under static and dynamic conditions; survey of modern soil mechanics testing techniques; influence of real soil behaviour on the performance of scale models.

8.760G Materials of Construction (Concrete Technology) 2 C3

Concrete as a structural material, with special application to marine structures. Volume changes, shrinkage and thermal stresses; creep; predicated and design values. Cracking of plain and reinforced concrete, fracture toughness and extensibility; cracking problems caused by volume changes and creep effects in mass and offshore-type structures. Bond and impact strengths. Durability and fatigue of reinforced and prestressed concrete. Types of durability breakdown, sea water attack, FIP and other design recommendations and current research for marine structures. Special concretes.

8.764G Composites in Civil Engineering C3

History; relationship between structure and mechanical and physical properties. Elastomers, adhesives, reinforced plastics natural composites. Applications and case studies.

8.766G Welding in Structual Engineering C3

Terminology, welding processes, metallurgy, weldability of ferrous and non-ferrous metals, pre-heat and post-heat treatments residual stresses and distortion, weld quality levels, destructive and non-destructive testing, economic welded design, quality assurance.

8.771G Foundation Engineering C6

A specialized study of theoretical and practical aspects of geotechnical engineering directly relevant to the analysis and design of foundation systems. The primary object of the course is to establish the state-of-art with particular emphasis on the application of recent theoretical developments to foundation engineering, including piles, rafts, raft-piles, laterally loaded piles, retaining structures and techniques of strengthening soils.

8.773G Materials of Construction (Metals) 3 C3

Previously 8.756G.

Use of metals as structural materials; specification; structural aluminium alloys; modern steels; philosophy of materials selection; properties, applications, limitations; behaviour under mechanical loading; effects of environment; corrosion and corrosion protection.

8.774G Soil Dynamics C3

Fundamentals of vibrations; wave propagation in elastic; homogeneous medium; wave propagation in layered medium; vertical, sliding, torsional and rocking motion or footings on elastic half-space; behaviour of dynamically loaded soils; design procedures for dynamically loaded foundations.

8.775G Geotechnical Aspects of Natural Hazards C3

Basic principles involved in earthquake engineering; treating on seismic waves; earthquake effects on foundations of buildings, dams slopes and embankments, intake towers, etc. Criteria for earthquake resistant design; landslides and their effects on soil slopes; probabilistic evaluation of slope failures; treatment of slopes; liquefaction.

8.776G Rock Mechanics C3

Strength and deformation characteristics of rock mass and joints; flow through joints and porous rock; failure criteria; stresses and deformations around underground openings; tunnel lining and rock anchors; stability of rock slopes; stabilization of rock slopes; stability of underground excavations related to mining; foundations of dams in fissured and layered rocks.

8.777G Numerical Methods in Geomechanics C3

Fundamentals of finite element and boundary element methods; deformation and flow problems; linear and non-linear analysis; applications 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.

8.778G Geotechnical Processes for Energy Resources C3

Principles of rock fragmentation: blasting patterns; prediction and estimation of ground vibrations; damage criteria; numerical techniques for the prediction of rock fracture; grouting materials and techniques.

8.779G Building Materials Technology in Third World Countries C3

Appropriate technology and building, traditional materials; cement and concrete, bricks, soil and stabilized soil, timber and timber products, composite materials, ferrocement; material selection.

8.780G Geological Engineering C3

Rock stability investigations, mapping of exposed structures, in-site, strength and deformation measurements. Drilling techniques, logging and representation of engineering geological information. Photogrammetric mapping and techniques. Classification of discontinuities in rock and mechanics of faulting and fracture. Strain analysis for rock masses.

8.802G Elastic Stability 1 C3

Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames.

8.803G Elastic Stability 2 C3

Energy methods of formation of stability problems. Approximate methods. Thin-walled open section struts; lateral buckling of beams; bending and buckling of thin plates.

8.804G Vibration of Structures 1 C3

Review of basic aspects. Analysis of lumped mass systems with various degrees of freedom. Vibration in beams and other continuous structures.

8.805G Vibration of Structures 2 C3

Vibration of buildings. Earthquake and blast loading. Bridges under moving loads. Vibration effects in foundations. Generalized dynamics and Lagrange's Equations.

8.806G Prestressed Concrete 1 C3

Historical development. Methods of prestressing. Elastic analysis and design. Flexural capacity and shear capacity of prestressed elements.

8.807G Prestressed Concrete 2 C3

Analysis and design of statically indeterminate structures. Methods of securing continuity. Composite structures.

8.808G Prestressed Concrete 3 C3

Partially prestressed concrete; cracked section analysis; crack control and deflection calculations; determination of appropriate level of prestress; strength calculations. Rational design procedures for prestressed members. Continuous beams; secondary moments; practical design procedures.

Prestressed slabs; two-way slabs; flat slabs; load balancing approach to design, effect of tendon distribution; design procedures; flexural and shear strength; deflections.

8.809G Reinforced Concrete 1 C3

Historical development. Methods of analysis and design, including limit state concepts. Analysis and design for bending, compression and combined bending and compression. Shear and torsion. Serviceability requirements.

8.810G Reinforced Concrete 2 C3

Creep and shrinkage effects in concrete structures. Application of limit theorems to structural concrete. Lower bound methods of design. Analysis and design of plates and slabs. Slenderness effects in columns.

8.811G Reinforced Concrete 3 C3

Preliminary design of concrete structures. Detailing of members and connections for strength and serviceability. Joints. Fatigue effects. Composite construction. Design of multi-storey buildings. Marine structures.

8.812G Plastic Analysis and Design of Steel Structures 1 C3

The perfectly plastic material, the plastic hinge; plastic collapse of beams and frames; upper and lower bound theorems; introduction to design principles and methods.

8.813G Plastic Analysis and Design of Steel Structures 2 C3

Estimation of deflections; factors affecting plastic moment; shakedown; three-dimensional plastic behaviour; minimum weight design.

8.814G Analysis of Plates and Shells C3

Stress and strain in thin elastic plates bent by transverse loads. Solutions of the plate equation. Application. Stress and strain in thin plates loaded in the plane of the plate. Applications.

8.817G Experimental Structural Analysis 1 **C3**

Dimensional analysis and principles of similitude, model analysis and design of models. Instrumentation and special methods of measurement. Evaluation of data.

8.818G Bridge Design 1 **C3**

Historical development. Design philosophies. Loadings and factors of safety. Design of slab and slab-and-beam bridges; skew and stiffened-kerb bridges, multibeam bridge decks. Analysis of orthotropic plates and grid frames. Plate web girders and box girders.

8.819G Bridge Design 2 **C3**

Advanced bridge design. Box girder and cable-braced bridges in steel and reinforced concrete. Orthotropic plate construction. Design of bridges by limit state methods. Serviceability requirements.

8.820G Structural Analysis and Finite Elements 1 **C3**

Stiffness analysis of structures. Basis of finite elements: Principle of virtual work, variational theorems, constraint equations. Effects of inplane rigid floors and axially rigid members on the behaviour of multi-storey frames.

8.821G Structural Analysis and Finite Elements 2 **C3**

Variational formulation of the finite elements. Plane stress and plate-bending elements. Mesh grading. Flat slabs and flat plates in building frames. Hybrid elements and shear wall analysis. Isoparametric elements, numerical integration. Finite elements methods in numerical analysis.

8.822G Structural Analysis and Finite Elements 3 **C3**

Application of the finite element method to analysis of structures. Verification of the results of standard computer programs. Structural stability and vibration of structures.

8.830G Hydromechanics **C3**

General equation of fluid motion, potential flow, conformal mapping, laminar flow, Navier-Stokes equations; turbulence, shear flows, jets and wakes, boundary layers, turbulent mixing, diffusion, air entrainment, cavitation, stratification.

8.831G Closed Conduit Flow **C3**

Theories for energy loss in conduit flows, roughness at pipe walls and tunnels, design applications. Cavitation in conduits, transport of waterborne mixtures in pipes, accuracy of flow measurement in pipe lines.

8.832G Pipe Network and Transients **C3**

Multiple and branching pipes, energy distribution in pipe systems. Computer solution of pipe network problems. Unsteady flow in pipes. Branching pipes and reflectors. Effect of pumping plant behaviour.

8.833G Free Surface Flow **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.

8.835G Coastal Engineering 1 **C3**

Theory of periodic waves as applied to tides and wind generated waves in water of varying depths. Wave and tide prediction.

8.836G Coastal Engineering 2 **C3**

Wave forces on structures, shore processes and beach erosion. Estuarine hydraulics, wave and tide models.

8.837G Hydrological Processes **C3**

Hydrologic cycle, water and energy balances, atmospheric moisture, precipitation process, evaporation and transpiration, storm runoff process, land use and management, stream gauging, instruments.

8.838G Flood Design **C3**

Excluded: 8.846G.

Introduction to flood estimation, design rainfall data, hydrograph analysis, storm runoff, loss rates, rational method, unit hydrographs, introduction to urban drainage design, flood frequency.

8.839G Advanced Flood Estimation **C3**

Flood routing, catchment characteristics, runoff routing, synthetic unit hydrographs, urban runoff, regional empirical flood estimation methods, advanced unit hydrograph theory.

8.840G Reservoir Design and Yield Determination **C3**

Storage-yield analysis, extension of runoff records, deterministic catchment models, stochastic hydrology, storage probability studies, spillway capacity and reservoir flood routing.

8.841G Hydrometeorology **C3**

Water and energy balances, atmospheric moisture, precipitation, evaporation and transpiration, snow and snowmelt, extreme precipitation.

8.842G Groundwater Hydrology **C3**

Confined and unconfined aquifers, analogue and digital models of aquifer systems, water movement in the unsaturated zone, recharge, groundwater qualify, sea water intrusion.

8.843G Groundwater Hydraulics **C3**

Mechanics of flow in saturated porous materials, steady and unsteady flow to wells, leaky aquifers, partial penetration, multiple aquifer boundaries, delayed yield from storage, regional studies.

8.844G Soil-Water Hydrology **C3**

Hydrologic characteristics of unsaturated media, hysteresis, theory of infiltration, drainage and redistribution studies, laboratory and field instrumentation, applications to field problems.

8.846G Urban Drainage Design **C3**

Excluded: 8.838G.

Introduction to flood estimation design, rainfall data hydrograph analysis, storm runoff, loss rates, rational method. Urban drainage design.

8.847G Water Resources Policy **C3**

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

8.848G Water Resource System Design **C3**

Principles of the optimal design and operation of multiple purpose, multiple component, water resource systems; evaluation of cost and benefits in complex and simple systems.

8.849G Irrigation **C3**

Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement; irrigation efficiency. Design of irrigation systems, appurtenant works, distribution.

8.850G Drainage of Agricultural Land **C3**

Characteristics of drainage systems, steady and unsteady state drainage formulae, conformal transformation solutions, soil characteristics field measurement of hydraulic conductivity and soil water pressure, significance of unsaturated zone, practical aspects.

8.851G Unit Operations in Public Health Engineering **C3**

Theory of physical, chemical, biological, and hydraulic processes used in both water and wastewater treatment. Applications where these are common to both water and wastewater treatment.

8.852G Water Distribution and Sewage Collection **C3**

Water collection, transmission and distribution systems — layout design and analysis, reservoirs, pumping. Sewage collection design and analysis — capacities, corrosion, pumping.

8.854G Solid and Liquid Waste Management **C2**

Sources and nature of refuse-collection and transportation-disposal: sanitary landfill, incineration, pyrolysis, resource recovery, composting. Collection, treatment and disposal of strong liquid wastes.

8.855G Water and Wastewater Analysis and Quality Requirements **C3**

The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

8.856G Water Treatment **C3**

Application of processes and process variations used to upgrade the quality of water for specified uses, with particular reference to the treatment of water for municipal use.

8.857G Sewage Treatment and Disposal **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.

8.858G Water Quality Management **C3**

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and re-use systems.

8.860G Investigation of Groundwater Resources 1 **C3**

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources 2 **C3**

Geophysical methods, remote sensing, photo-interpretation, arid-environment studies, analog models, case studies.

8.862G Fluvial Hydraulics **C3**

Unsteady and varied flow in non-uniform channels, secondary currents, sediment transport, channel morphology, scour and shoaling, river control works, modelling of fluvial processes.

8.863G Estuarine Hydraulics **C3**

Classification of estuary types and their characteristics. Tides, their origin, prediction and effect on estuarine circulation. Entrainment and mixing process in estuaries. Salinity intrusion, tidal flushing, dispersion of pollutants. Sediment transport, channel stability.

8.864G Arid Zone Hydrology **S1 L1½T1½ C3**

Co-requisite: 8.837G, 8.838G.

Arid zone rainfall characteristics, data collection and instrumentation, runoff processes, infiltration, transmission loss, recharge processes, flood characteristics and design; water yield, storage of water; evaporation and evaporation suppression; sediment transport and measurements.

8.865G Arid Zone Water Resources Management **S1 or S2 L1½T1½ C3**

Water as a resource: demand for and supply of water; works and management to match demand with supply. Special features of the arid zone climate, water uses, quantification of demand quantities and qualities; measurement of flow rate, volume, quality. Engineering works: design, construction, operation and maintenance of works, 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.

8.901G Civil Engineering Elective 1 **C3**

A Session 1 occasional elective on a civil engineering topic, selected according to current demand and availability of local and visiting specialists.

8.902G Civil Engineering Elective 2 **C3**

A Session 2 occasional elective on a civil engineering topic, selected according to current demand and availability of local and visiting specialists.

8.909G Project **C9**

A minor research investigation involving analysis and interpretation of data, or a critical review and interpretation of literature on a selected topic, or a design project.

8.918G Project Report **C18**

As for 8.909G but involving more substantial investigation.

8.936G Thesis **C36**

Mathematics

10.061G Advanced Mathematics for Electrical Engineers **C3**

Boundary value problems in partial differential equations. Selected topics from complex variable analysis, integral transforms, and orthogonal functions and polynomials.

10.361G Statistics **C3**

Probability theory, a survey of random processes with engineering applications — processes in discrete and continuous time. Markov processes, ergodicity, stationarity, auto-correlation, power spectra, estimation of auto-correlation and power spectra.

10.371G Statistics **C3**

Revision of probability and distribution theory, including estimation of hypothesis testing. Extension of this to include topics such as more complex probabilistic modelling, analyses of modified data (censored, truncated andd missing observations), general statistical inference (decision theory), acceptance testing, and reliability analysis (hazard functions).

32.012G Biomedical Statistics **S1 L2½ T1½ C4**

Statistical assessment of normal and diseased states. Statistical relationships between multiple variables used to assess disease; analysis of variance, regression, factor analysis, discriminant analysis. Progression of diseases over time. Diagnosis and assessment of treatments. Experimental design and sampling. Computation methods.

32.101G Mathematical Modelling for Biomedical Engineers **S1 L3T1 C4**

Model formulation and validation of ordinary and partial differential equations by analytical and numerical techniques.

Accountancy

14.042G Industrial Law **C2**

The elements of the law of contract and tort as applied to industrial law; the New South Wales and Commonwealth industrial arbitration systems, including award making and interpretation, and industrial disputes; workers' compensation.

14.062G Accounting for Engineers **C3**

Problems related to industrial situations, and their relevance in decision-making. Manufacturing and cost accounts, budgeting and budgetary control, cost analysis and control and profit planning.

Economics

Industrial Relations

15.565G Industrial Relations A — S1 L3

Prerequisite: Nil.

Concepts and issues in Australian industrial relations at the macro or systems level, with overseas comparisons where appropriate. Labour movements and the evolution of employee-employer relations in the context of industrialization and change; origins and operations of industrial tribunals at the national and state levels; structure, operation and objectives of Australian trade unions and employer bodies; role of governments and their instrumentalities; nature of industrial conflict and procedures for conflict resolution such as arbitration and bargaining; and national wage policy.

Health Administration

16.901G Health Services Statistics 1 — S1 L2

Statistical methods and theory: frequency distributions and their descriptions; an introduction to probability; principles of sampling; estimation and hypothesis testing; statistical decision theory; normal, Poisson and binomial distributions; linear regression; index numbers; time series analysis. Data drawn from the health planning field used to illustrate these methods.

Industrial Engineering

Industrial Engineering is a Department within the School of Mechanical and Industrial Engineering.

18.061G Industrial Experimentation 1 — C3

Design of experiments with reference to industrial problems; planning experiments; significance testing; simple comparative experiments, accelerated experiments; fatigue testing, tool life testing; economic aspects of experimental design; analysis of variance or randomized block, latin square and factorial experiment designs.

18.062G Industrial Experimentation 2 — C3

Regression analysis; use of orthogonal polynomials in regression analysis and analysis of variance; confounding in factorial design; response surfaces and determination of optimum conditions.

18.074G Industrial Management — C3

Definitions of management; evolution of management thought, classical, quantitative and behavioural schools; interactions between organizations and their environment. The planning process; strategic and tactical planning, developing planning premises, nature of managerial decision making, quantitative aids, management by objectives. Organizational structures; co-ordination and spans of control, the informal organization, authority delegation and decentralization, groups and committees, managing organizational change and conflict. Motivation, performance and satisfaction; leadership, interpersonal and organizational communication, staffing and the personnel function. The control process; budgetary and non-budgetary methods of control, use of management information systems.

18.075G Decision Support Systems — C2

Perspectives on organizational and individual decision making; basic philosophy of Decision Support Systems; knowledge representation techniques; DSS models and operators; Data Base Management systems in DSS; iterative design techniques; the DSS/user interface; practical design and implementation of a Decision Support System.

18.171G Inspection and Quality Control — C3

Economics of measurement; advanced measuring and inspection methods; non-destructive testing; quality control systems; sampling by attributes and variables; standardization; case studies; process capability and variability; machine tools acceptance testing; alignment procedures.

18.260G Computer Aided Programming for Numerical Control — C3

Excluded: 18.224.

Overview of N.C. systems and manual programming. Requirements of a high level language designed specifically for programming N.C. machine tools. Computer Assisted Programming dealing with specific and generalized part programming. Detailed study of the structure and use of 'Automatic Programmed Tools' (APT) language including overview of language, basic APT grammar, part program structure, geometry statements, motion statements, macro commands, postprocessors, diagnostics.

18.261G Computer Automation — C3

Computer architecture including central processer, random-access memory, read only memory, input/output ports, peripherals, and the relationships between each. A systematic study of the requirements for interfacing computers to the real world. Machine code, assembly language, and high level languages such as BASIC or FORTRAN with a comparison of each for particular applications. Development of small computer system for machine tool control, automated inspection, supervision, stock control, etc.

18.360G Ergonomics — C3

Applied anatomy and kinesiology, anthropometry; application to work place arrangement, seating and bench design, tool and equipment design, lifting techniques, consumer product and architectural design. Physiological and psychological aspects of work and fatique;

measurement of energy consumption, limits to energy expenditure at work, static muscular fatigue, boredom. Environment effects; natural and artificial lighting arrangements, problems of perception, colour; noise and vibration, physiological and psychological effects, preventive measures; heat and ventilation, thermal regulation in humans, criteria for comfort, effects of pollutants. Man-machine interface. Displays, machine controls, reaction times, vigilance. Applications of ergonomics to occupational safety and health. Ergonomic research methology.

18.371G Factory Design and Layout C3

Prerequisite: 18.303 or 18.380G or equivalent.

Production Requirements: Processes, machines and storage; optimum factory size, multiple factories. *Plant Location:* Single and multiple factories and warehouses; location models and economic analysis.

Factory Design: Function; appearance; economic factors; environmental factors. *Materials Handling Systems:* Influence on layout; economic choice between alternatives; long-distance transport. *Layout Design:* By product: types of production line, means of line balancing, queueing theory applications. By process: travel charts and computer programs for optimization. Group Technology. Practical aspects; provision of services and amenities; layout visualization methods.

A project forms a substantial proportion of the assessment for this subject.

18.380G Methods Engineering C4

Methods Study: History and objectives. Charting and systematic improvement of methods, factory and workplace layout. Physical and social aspects of working conditions. *Work Measurement:* Defining and using 'standard times'. Time study techniques and problems, predetermined motion-time systems, work sampling, standard data and formulae. Accuracy and statistical testing of data. *Industrial Psychology:* Motivation to work, frustration and conflict in industry, sources of job satisfaction. Financial incentive schemes, job enrichment and worker participation.

18.461G Design Production C4

Influence of manufacturing processes on design; design simplif ication and standardization; value engineering; economics of process selection; case studies.

18.464G Value Analysis and Engineering C3

Cost reduction through value analysis/engineering illustrated by case studies. Selection of projects to be studied, collection of information, creative problem solving, development of alternatives, functional analysis system technique, functional evaluation, cost-function relationship, decision making, communication and implementation of the proposal. Applications to engineering design and services.

18.465G Computer-Aided Manufacturing C3

Brief review of numerical control (NC) manufacturing systems. Elements of the CAM systems: CAM data base, production management, manufacturing control. Computers in manufacturing. Computer process monitoring and control. Production systems at the plant and operations levels. Supervisory computer control. Flexible manufacturing systems.

18.471G Design Communication C2

Communication systems in design; aids to design communication; engineering drawing practice; standardization; interpretation of design information.

18.571G Operations Research 1 C6

Excluded: 18.503, 18.551, 18.580G.

The formation and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models and simulation. These techniques are applied to situations drawn from industrial fields, for example, production planning and control. Practical problems of data collection, problem formulation and analysis.

18.574G Management Simulation C3

Problem definition. Principles of model building. Participation in an operational simulation. Construction of decision rules. Operations. Research case studies and seminars.

18.579G Case Studies In Operations Research C3

Problems confronting management are seldom in the form of clear cut textbook type exercises; rather they are often ill-structured and ambiguous. A variety of such problems in operations research/ management science is considered with emphasis on the common pitfalls that arise in solving real world problems and the comparison of different strategies for solution. Students are expected to prepare written reports on certain cases considered suitable for submission to management.

18.580G Operations Research C6

Excluded: 18.503, 18.551, 18.571G.

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.

18.671G Decision Theory C2

Excluded: 18.672G.

Theories of choice, value risk uncertainty for the individual and for multi-person situations. Statistical decision theory. Bayes and minimax rules.

18.672G Decision Theory for Industrial Management C3

Excluded: 18.671G.

Decisions with multiple objectives. Indifference curves and tradeoffs. Value functions for two or more attributes. Decisions under uncertainty. Utility theory. Bayesian decisions in discrete and continuous space. Value of information. Optimal sampling. Applications in investment, marketing, production.

18.673G Energy Modelling, Optimization and Energy Accounting C3

The analysis of energy systems using computer models. Applications of such models range from policy analysis at government level to investment analysis within individual industries. Covers both the formulation of energy models and the techniques used to obtain optimized solutions, with examples from actual studies. Effects of uncertainty and the use of energy accounting as an analytical tool.

18.675G Economic Decisions in Industrial Management C3

General aspects: the economic objective, the single-period investor's model, economic criteria, the mathematics of finance.
Deterministic models: project evaluation using discounted cash flow analysis; capital structure; debt and equity financing; cost of capital and the minimum acceptable rate of return; taxation; inflation and its effects.

Probabilistic models: multiple objectives and multi-attribute value systems based on means and variances of cash flows.

Particular applications of economic decision-making: venture and risk analysis, risk management, static and dynamic replacement models, rent-or-buy decisions, breakeven analysis, expansion and economic package concepts, analysis of projects with public financing.

18.681G Engineering Economic Analysis C3

Price-output decisions under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their application in the selection and replacement of processes and equipment. Construction and optimization of particular models, eg replacement, capital rationing. Measures of profitability.

18.760G Discrete-Event Simulation Languages C3

Prerequisite: 18.503 or 6.646 or 18.761G.

Basic elements of simulation languages: random number generation, process generation, list and set processing, data structures, time advance and event scanning, gathering and resetting statistics, graphics, Simulation language world views. Comparative review of commercially available simulation languages such as Simscript, GPSS, ECSL, and Simula, and a study of one of them in depth. Simulation using personal computers. Simulation language preprocessors.

18.761G Simulation in Operations Research C3

Excluded: 18.503, 6.646.

The relationship of simulation to other methods of comparing alternative solutions to industrial problems. Computer simulation languages. Process generation. Variance reduction techniques. Analysis of simulation generated time series. Formulation and construction of models for simulation. Problems of simulation. Design of simulation experiments. Optimization through simulation. Examples of the use of simulation. Heuristics.

18.763G Variational Methods in Operations Research C2

The variational problem and its history. The modern formulations. Mathematical Theory. Application to a wide range of problem areas such as production and inventory control, advertising, machine maintenance and natural resource utilization.

18.764G Management of Distribution Systems C2

Prerequisite: 18.503.

The distribution system: single depot location, multi-depot location, vehicle scheduling, vehicle loading, fleet size, case studies.

18.765G Optimization of Networks C2

Prerequisite: 18.551.

Network representation of decision problems. Activity networks PERT-CPM, Euler and Hamiltonian paths, shortest path, maximum flow, multi-commodity flow, out-of-kilter algorithm, convex cost networks, stochastic cost networks — GERT.

18.770G Stochastic Control C2

Markov decision processes for finite and infinite planning horizons. Optimality criteria. Contraction mappings. Computational techniques. Optimal stopping. Semi-markov decision processes. Application to inventory, replacement and queues.

18.772G Information Processing Systems in Organizations C2

Not offered in 1985.

The place of operations research in information processing systems. Computer hardware and software. Data structures and data manipulation techniques. Typical structures of suites of programs. The life cycle of information processing systems. System design. Applications packages with emphasis on systems for production and inventory control. Major problems in information processing systems.

18.773G Optimal Control in Operations Research C2

Brief survey of dynamic optimization techniques. Introduction to the calculus of variations and the maximum principle for both continuous and discrete systems. Applications to operations research problems drawn from the areas of production and inventory control, machine maintenance, investment and natural resource utilization.

18.774G Applied Stochastic Processes C2

Examples of stochastic processes, basic concepts and Markov chains. Renewal theory. Applications to queues, inventory replacement, risk, business and marketing. Markov decision processes.

18.775G Networks and Graphs C2

Basic concepts. Application of Hamiltonian paths, Euler cycles, trees, planar graphs, dominating and independent sets to operations research problems. Shortest route algorithms. Concept of maximum flow in a network applied to transportation assignment and scheduling problems.

18.776G Production and Inventory Control C2

Overview of the basic issues in Production and Inventory control. Material Requirements Planning: the Master Production Schedule; structuring Bills of Materials for MRP; Capacity planning and control; shop floor scheduling and lead time reduction; cycle counting; lot sizing techniques; implementation of MRP systems in practice. Just-in-Time (JIT) production; the Kan Ban system; production planning and control in Flexible Manufacturing Systems (FMS); the relation between MRP, JIT and FMS.

18.777G Time Series Forecasting C2

Stationary series. Autoregression. Spectral analysis. Estimation of trends, seasonal effects and parameters. Exponential smoothing. Error analysis and tracking signal. Choice of method.

18.778G Scheduling and Sequencing C2

Criteria for evaluation schedules. Scheduling of single machines. Job-shop scheduling with two, three or more machines. Permutation schedules. Groups of machines. Scheduling constrained resources.

18.779G Game Theory C2

Two-person zero-sum games: the minimax theorem, relationship to linear programming. Two-person general-sum games. Non-co-operative and co-operative n-person games. Games without side payments. Economic market games.

18.780G Production Control C2

Modes of manufacture; information flow in multi-stage production systems; classical production and inventory models and control techniques; Material Requirements Planning; Just-in-Time Production; Flexible Manufacturing Systems and their control.

18.862G Linear Programming C2

Formulation of models. The revised simplex method. Sparse matrix techniques. Implementation on computers. Duality and postoptimality analysis. Extensions to the simplex method. Generalized upper bounding. Decomposition. Integer programming. Applications in industry.

18.863G Nonlinear Programming C2

Formulation of models. Single variable optimization. Numerical techniques for unconstrained optimization. Methods for linear constraints. Penalty function methods for nonlinear constraints: Lagrangian methods. Applications in industry.

18.864G Applied Geometric Programming C2

Optimization concepts developed for function of polynomial form. Solution techniques for such problems, sensitivity of solution. Applications of geometric programming to problems from engineering and operations research.

18.870G Large Scale Optimization in Industry C3

Large-scale linear programming: sparse constraint matrices, updating basis factorizations. Large-scale nonlinear programming: the limitations of classical quasi-Newton and conjugate gradient methods, sparse Hessian approximations, superbasic variables, augmented Lagrangian methods for sparse nonlinear constraints. Applications, examples and case studies from industry: optimal power flow, steam and power plant design, pipeline network optimization and other.

18.871G Mathematics for Operations Research C2

Classical optimization techniques. Convexity. Kuhn-Tucker conditions. Search and gradiant methods in one and several dimensions. Probabilistic models and their optimization. Curve fitting, correlation and regression.

18.874G Dynamic Programming C2

The principle of optimality. Structure and formulation of dynamic programming problems. One-dimensional deterministic and probabilistic sequential decisions. Approximations in function and policy space. Multidimensional problems, computational aspects. Applications to allocation problems, inventory theory, replacement.

18.875G Geometric Programming C2

The geometric programming theory is developed for convex and non-convex mathematical programs. The theory is applied to polynomial and posynomial programming. As projects actual polynomial and posynomial programs will be solved.

18.876G Advanced Mathematics for Operations Research C2

A survey of mathematical ideas which are of value in operations research. Topics will be selected from the following areas: set theory, real analysis, matrix theory, topology, function spaces, linear operatory theory, inequalities, stability, complex analysis, convex analysis, distribution theory, group theory and measure-theoretic probability theory.

18.878G Industrial Applications of Mathematical Programming C2

Problem formulation: profitability criteria, operating constraints. Conventions for large-scale matrix construction; list and table-processing, error-checking. Use of commercial systems: data organization, interpretation of output, ranging procedures. Examples from actual industrial studies.

18.879G Mathematical Programming Analysis C3

Co-requisites: 18.871G; Linear Programming section of 18.571G.

Methods for the analysis of mathematical programs. Analysis of the properties of linearity, separability, convexity, quasi-convexity and duality, providing the basis of the conversion of mathematical programs to potentially simpler formulations. Includes the areas of geometric programming, convex programming and quasi-convex programming.

18.909G Project C9

18.918G Project Report C18

18.936G Thesis C36

18.965G Seminar (Industrial Management) C0

18.967G Advanced Topic in Production Engineering C2

18.968G Advanced Topic in Production Engineering C2

18.969G Advanced Topic in Production Engineering C2

Allows the presentation of special topics, particularly by visiting academics.

18.970G Seminar (Operations Research) C0

18.975G Advanced Topic in Industrial Engineering C3

18.976G Advanced Topic in Industrial Engineering C3

18.977G Advanced Topic in Operations Research C2

18.978G Advanced Topic in Operations Research C2

18.979G Advanced Topic in Operations Research C2

Allows the presentation of special topics, particularly by visiting academics.

Nuclear Engineering

Not all subjects are available in any one year.

23.013G Neutron Transport and Diffusion S2 L2½T½ C3

Neutron and nuclear reactions, the formation of neutron spectra in infinite multiplying media, transport and diffusion theories, and their application to the analysis of heterogeneous reactor lattices.

23.014G Fewgroup Reactor Theories S2 L2½T½ C3

Not offered in 1985.

The derivation and use of fewgroup reactor models for the macroscopic analysis of finite reactor criticality, burnup and control.

23.015G Multigroup Reactor Theories S2 L2½T½ C3

A selection of topics from general reactor theory, variational principles, perturbation theory, and multigroup transport theory, for the general problem of three-dimensional fine scale neutron flux distribution analysis.

23.016G Neutron Kinetics and Reactor Dynamics S1 L2½T½ C3

Not offered in 1985.

The derivation and application of point reactor kinetic models to the study of macroscopic power reactor dynamics, stability and control, and the development of general space-time kinetic models.

23.023G Reactor Thermal Performance S1 L2½T½ C3

The processes of heat generation, conduction, heat transfer and heat and momentum transport in fluids, in relation to the thermal performance of reactor channels and cores.

23.024G Boiling and Two Phase Flow S1 L2½T½ C3

Not offered in 1985.

Subcooled and bulk boiling, boiling crises, and the special problems associated with the analysis of reactor channel and core performance under boiling and two-phase flow conditions.

23.025G Reactor Structural Mechanics S1 L2½T½ C3

Not offered in 1985.

A study of theoretical models and numerical techniques required for the analysis of mechanical and thermal stress, deformation, and failure modes of reactor core components and containment structures under high temperature, neutron and gamma irradiation.

23.026G Reactor Systems Analysis S2 L2½T½ C3

Not offered in 1985.

Nonlinear and linear system dynamics and stability theory applied to reactor processes and components, for the development and use of overall reactor and power system dynamics models.

23.027G Boiling Reactor Dynamics S1 L2½T½

Not offered in 1985.

The special problems associated with the dynamics and stability of fluid cooled reactors under boiling conditions.

23.028G Reactor Accident and Safety Analysis S2 L2½T½ C3

The mathematical modelling and computation of ideal and actual reactor accident histories, particularly for fluid cooled systems, and the application of probability theory to reactor hazard evaluation.

23.032G Mathematical Analysis and Computation S1 L2½T½ C3

Mathematical methods, partial differential equations, special functions, and numerical methods for digital computation, relevant to Nuclear Engineering.

23.033G Matrix Theory and Computation S2 L2½T½ C3

Matrix theory and matrix computations required for the numerical solution of problems in neutronics, fluid dynamics, structural mechanics, etc, arising in the analysis and prediction of nuclear power system performance.

23.034G Random Processes and Reactor Noise S2 L2½T½ C3

Not offered in 1985.

The mathematics of random processes applied to fluctuation phenomena in nuclear reactors, and the practical application of noise analysis techniques to reactor monitoring, control, and parameter estimation.

23.042G Nuclear Fuel and Energy Cycles S1 L2½T½ C3

The utilization of nuclear energy, the thermodynamics of nuclear power systems and applications, and the study of nuclear fuel cycles.

23.043G Nuclear Power Costing and Economics S2 L2½T½ C3

The principles of nuclear power cost estimation for various reactor types and applications, the comparative evaluation of nuclear power systems, and the problem of reactor strategy.

23.044G Nuclear Engineering Optimization S2 L2½T½ C3

Not offered in 1985.

The theory and application of function and functional minimization techniques to problems of design, control and operation of nuclear reactors and associated nuclear fuel supply complexes.

23.045G Uranium Enrichment Technology S1 L2½T½ C3

The theory and technology of uranium enrichment by the diffusion, ultra-centrifuge and nozzle processes; the economics of enrichment within the nuclear reactor fuel cycle, in relation to optimal reactor strategy and resources utilization.

23.909G Project F C9

23.918G Project Report F C18

23.936G Thesis F C36

Geography

27.043G Remote Sensing Applications S1 L1T2 C3

The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multi-temporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

27.171G Directed Problems in Remote Sensing S2 L1½T1½C3

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 L2T1C3

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, processing and analysis of imagery obtained from the following satellite programs: Landsat, Skylab, Heat Capacity Mapper Mission, Geodynamics Experimental Ocean Satellite, NOAA-7, Nimbus Coastal Zone Color Scanner, Seasat, Space Shuttle, Spot and Soyuz-Salyut.

27.672G Geographic Information Systems C2

Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping.

27.901G Geomorphology for Hydrologists **S2 L1½T1½ C3**

Offered subject to availability of staff.

Geomorphological controls in the development of drainage systems. Geomorphology of drainage basins and channel networks. Forms of river channels. River floodplains and terraces. Drainage basins and networks as geomorphological systems. Geomorphology in predictive modelling of basin hydrological response and in the assessment of water resources. Geomorphology of representative basins. Short-term and long-term geomorphic changes. Air photo and map analysis of drainage basins and networks. Field study of fluvial landforms and drainage basins and networks.

27.911G Soil Erosion and Conservation **S1 or S2 L2T4 C6**

Climatic, vegetational, geomorphic and pedologic controls of erosion. Physical processes of sediment transport and deposition. Conservational measures for the prevention of erosion including constructional and management practices. Methods of assessing soil loss risk and erosion hazard evaluation.

Marketing

28.913G Marketing Management **S2 L3**

Prerequisites: 28.911G and 28.912G.

Conceptual framework relevant to the practice of marketing management developing an understanding of the market function. Emergence of a broader concept of marketing; relationship between corporate and marketing strategy; the marketing environment; market segmentation; marketing planning; determination of product, price channel, advertising and salesforce policies; marketing control.

Surveying

29.101G Aspects of Electromagnetic Distance Measurement **SS L2T1 C3**

New developments in electronic distance measurement instruments including multiple wavelength systems, interferometers, optical transponders. Component properties of instrumental errors. Techniques of instrumental calibration and establishment of calibration facilities. High precision measurement techniques.

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. Details of syllabus and lecturer to be communicated to the Higher Degree Committee on each occasion when the subject runs.

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 Observations **SS L2T1 C3**

Choice and analysis of adjustment models in geodetic triangulation and control surveys. Detection of outliers. Design optimization and analysis of survey control networks. Methods of carrying out very large continental adjustments.

29.171G Mathematical Methods 1 — Numerical Analysis **SS L2T1 C3**

Topics from real analysis, computational error theory, curve fitting by orthogonal polynomials, trigonometrical and exponential series, time series and quadrature.

29.172G Mathematical Methods 2 — Statistical Theory of Survey Observations **SS L2T1 C3**

Advanced application to survey observations of frequency distributions, moments, minimum variance, unbiased estimation, central limit theorem, analysis of variance and statistical testing. Outlying observations.

29.173G Mathematical Methods 3 — Spherical Harmonics **SS L2T1 C3**

Two dimensional Fourier Series. Theorems of vector field theory. The solution of Laplace's equation in spherical co-ordinates. Spherical harmonics.

29.174G Mathematical Methods 4 — Theory of Survey Adjustment **SS L2T1 C3**

Matrices, multivariate normal, distribution of quadratic forms, five standard problems of Tienstra, geometrical interpretation of least squares adjustment, free net adjustment and generalized matrix algebra. Solution of large sets of equations. Confidence ellipses.

29.175G Mathematical Methods 5 — Collocation **SS L2T1 C3**

Fundamental assumptions. The covariance function and its modelling. The solution and theoretical accuracy. Interpolation, filtering, prediction and transformation by collocation. Application in physical geodesy.

29.201G Geodetic Methods **SS L2T1 C3**

Motion of the earth in space. Reference coordinate systems. Geodetic boundary value problem. Horizontal control. Vertical control. Three-dimensional control, variation with time. Gravity. Worldwide and regional determination of positions. Global gravity measurements. Earth rotation and polar motion.

29.202G Earth and Ocean Dynamics **SS L2T1 C3**

Structure of the earth. Tectonic deformation. Response of the solid earth to external effects. Gravity. Earth rotation and polar motion. Surface ocean circulation and tides. Mean sea surface. Time varying sea surface.

29.203G Gravimetric Geodesy **SS L2T1 C3**

General principles of gravimetric geodesy. Data requirements. Gravity field extension techniques. Combination of satellite and surface gravity data. Gravitational field of the rotating ellipsoid. Fundamental equations for the solution of the boundary value problem. Solutions of geoid-ellipsoid separation and deflections of the vertical to the order of the earth's flattening. Comparisons of astrogeodetic and gravimetric solutions.

29.204G Geodetic Refraction **SS L2T1 C3**

Mathematical refraction theory: Electromagnetic wave propagation in an inhomogeneous and turbulent medium. Refractive properties of the atmosphere. *Principles of atmospheric models:* Boundary and surface layer meteorology. Structure of atmospheric turbulence. *Atmospheric effects:* Nature, instrumental solution and models of atmospheric effects on terrestrial and extraterrestrial geodetic measurements. Accuracy and precision requirements.

29.205G Satellite Geodesy **SS L2T1 C3**

Coordinate and time systems. Motion of the earth in space. Artificial satellite motion. Force model and variational equations. Measurement modelling and related derivatives. Orbit determination. Position and gravity field determination.

29.206G Advanced Geodetic Instrumentation **SS L2T1 C3**

Developments in: distance measuring instruments; Strainmeters; Tiltmeters. Optical-angle measurement instruments; Gravity measurements; Gravity gradiometers; Inertial navigation systems; Gravity measurements at sea; Tide gauges; Ocean pressure measurement; Bathymetry; Positioning on deep-ocean floor; Radio Doppler; Satellite laser ranging; global positioning system; Drag-free satellite technology; long base-line microwave interferometry and Satellite altimetry.

29.207G Doppler Positioning **SS L2T1 C3**

Introduction to Doppler positioning using the NNSS satellite system. The use of point positioning, translocation and short arc techniques. Review of available hardware. Majority voting; general and specialized reduction techniques. Computing techniques associated with the integration of Doppler positions into terrestrial network. Introduction to the Global Positioning System (GPS).

29.314G Geodetic Astronomy **SS L3T3 C6**

Some aspects of precise determinations of latitude, longitude and azimuth. PZT and Danjon astrolabe. The Laplace equation (implications of Black and Gregerson methods). Personal error. Precise timing; radio time signals and recording. Simultaneous determinations. Equal altitude techniques.

29.516G Mathematical Model of the Imaging Process **SS L3 C3**

Fundamental relationships, image and object space. Co-ordinate systems, collinearity equations. Interior orientation, camera calibration methods, direct linear transformation. Deviations from collinearity, use of reseaus. Generation of fictitious photographs. Realtime equations for analytical plotters, trade-offs in formulation. Simple exterior orientation of a single image. Non-frame sensors, unconventional imagery. Coordinate measuring devices.

29.517G Stereophotogrammetry **SS L2T1 C3**

Fundamental protective relationships, observation procedures, stereoscopic pointing. Relative orientation: empirical and numerical solutions. Absolute orientation; instrumental, numerical and graphic solutions. Model deformations from errors of interior, relative and absolute orientation. Composite spatial errors. Special cases: partial overlaps, mountainous terrain.

29.518G Analytical Photogrammetric Orientation **SS L3 C3**

Prerequisite: Prior knowledge of FORTRAN computer programming is assumed.

Review of method of least squares. General orientation determination for one and two images. Direct formation of reduced normal equations. Parameter estimates as observations. Use of constraints. Exterior orientation for analytical plotters. Relative and absolute orientation as special cases. Computer programs.

29.519G Photogrammetric Instrumentation **SS L2T1 C3**

Theory of instruments: comparators, restitution instruments, approximate instruments, ancillary equipment. Testing and calibration of instruments.

29.520G Photogrammetric Production Processes **SS L1½T1½ C3**

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry. Digital terrain models.

29.521G Control Extension A **SS L3 C3**

Prerequisite: 29.517G or consent of the instructor.

Early methods of photogrammetric control extension: radial triangulation, stereotemplets, bridging. Strip triangulation by picture connection in space. Method of independent bases. Independent models, perspective centre calibration. Graphic and numerical strip adjustment by polynomials. Analytical strip triangulation. Adjustment of blocks by iterated strip adjustment.

29.522G Control Extension B **SS L3 C3**

Prerequisite: 29.518G.

Simultaneous adjustment of strips and blocks: Anblock, general independent models, bundle method. Combining model and bundle concepts. Solution of large systems of symmetric, strongly diagonal, linear equation arrays: recursive partitioning, relaxation methods. Trade-offs in processing methods for different computer configurations. Computer programs.

29.600G Principles of Remote Sensing **S1 L2T1 C3**

History and development. Definition and physics of basic electromagnetic radiation quantities. Basic-energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electro-optical sensors. An introduction to data processing and enhancement, including image interpretation procedures.

29.601G Remote Sensing Principles and Procedures **S1 L2T1 and S2 L1½T1½ C6**

Electromagnetic radiation. Definition and physics of basic quantities. Photographic film, images and sensors. Electro-optical sensors. Data systems. Examples of operational systems. Positioning, preprocessing, deconvolution, enhancement and classification theory and application to Landsat data. Project involving processing of Landsat data.

29.602G Mass Appraisal Methods **SS L2T1 C3**

Property and property value. Early rent theory. Location theory. The interrelationship between land use and value. Traditional methods of appraisal. Appraisal methods using multivariate analysis. Comparison of methods. Recent studies on the determinants of property value. Multiple regression analysis, general linear models, trend surface analysis, factor and discriminant theory and application. Collection and coding of property data. Examination of temporal variation and trends. Graphic output of data-isoval maps. Value as one component of an urban information system.

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.

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.

29.706G Survey Management **SS L2T1 C3**

Introduction to management accounting. Information systems and accounting, balance sheets, income statements, accounting reports, costing, budgets and capital investment decisions.

29.707G Quantitative Management Methods **SS L2T1 C3**

Detailed analysis of operations research methods and discounted cash flow techniques as they apply to mapping, surveying and development projects. Various case studies and their solutions will be examined.

29.909G Project **C9**

29.918G Project Report **C18**

29.936G Thesis **C36**

Organizational Behaviour

30.935G Organization Behaviour A **S1 L3**

Organizations are examined as open systems exhibiting a variety of structural patterns within an external, economic, social, political and technological environment which is uncertain and rapidly changing. Against this background the subject lays the foundations for gaining insight into human behaviour in organizations.

Biomedical Engineering

32.009G Project **C9**

32.010G Biomedical Engineering Practice **S2 L2 C2**

Introduction to clinical situations in hospitals. Presentation of guest lectures by eminent people working in this field. Lecture topics include cardiology, neurology, orthopaedics, rehabilitation, etc. Visits to various biomedical engineering units.

32.012G Biomedical Statistics **S1 L2½ T1½ C4**

Statistical assessment of normal and diseased states. Statistical relationships between multiple variables used to assess disease; analysis of variance, regression, factor analysis, discriminant analysis. Progression of diseases over time. Diagnosis and assessment of treatments. Experimental design and sampling. Computation methods.

32.018G Project Report **C18**

32.020G Radiation Physics **S1 L3T1 C4**

Sources, effects and uses of radiation on human tissues. Ultrasonic, X-ray and nuclear radiations are included together with ultraviolet, infrared, laser, microwave and longer wavelength electromagnetic effects.

32.030G Thesis **C30**

32.040G Analogue Electronics for Biomedical Engineers **S1 L2 T2 C4**

Basic theory of passive components, simple network analysis, small signal amplifiers, feedback and oscillators, operational amplifiers and their uses, analogue integrated circuits. Boolean logic NOT, AND, OR, exclusive-OR functions, truth tables, flip-flops, latches, clocked circuitry, buffers, brief introduction to VSLI. Common displays. Safety requirements for medical instruments, circuit diagram analysis and component identification. Laboratory work involves both design and construction of analogue circuits.

32.050G Microprocessors and Circuit Design for Biomedical Engineers **S2 L2T2 C4**

Prerequisite: 32.040G and 32.501G or equivalents.

Examination of the fundamental analogue and digital circuits commonly found in medical applications. Emphasis is given to project-oriented practical experience involving aspects of biological signal acquisition by microcomputers.

32.101G Mathematical Modelling for Biomedical Engineers **S1 L3T1 C4**

Model formulation and validation, solution of ordinary and partial differential equations by analytical and numerical techniques.

32.311G Mass Transfer in Medicine **S2 L2T2 C4**

Material and energy balances, modelling of intrabody mass transfer, elementary treatment of diffusion, convection, hydraulic permeability and osmosis in biological and synthetic membranes. Applications to hemodialysis, blood oxygenators and artificial livers.

32.321G Physiological Fluid Mechanics **S2 L2T2 C4**

Fundamentals of biological fluid flow by way of the governing equations. Kinematics and dynamics, viscous and inertial flow, boundary layers, separation, physiological flows (cardiac, vascular, pulmonary, urinary, etc.) and flow in artificial organs.

32.332G Biocompatibility **S2 L2T1 C3**

Interaction of biological fluids and cells with foreign surfaces, *in vitro* tests to assess biocompatibility and thrombogenicity, current status of biocompatible materials as applied to hemodialysis, hemofiltration, membrane oxygenation and prosthetic devices.

32.501G Computing for Biomedical Engineers **S1 L2T2 C4**

Algorithm design and documentation, printer plotting, computer graphics, editing, CYBER/KCL and VAX/VMS systems. Overview of computers in biomedical engineering, including aspects of automated patient monitoring, laboratory testing, data storage and information retrieval.

32.510G Introductory Biomechanics **S1 L2T1 C3**

The principles of the mechanics of solid bodies: force systems; kinematics and kinetics of rigid bodies; stress-strain relationships; stress analysis of simple elements.

32.541G Mechanics of the Human Body **SS L2T1 C3**

Prerequisite: 32.510G or equivalent.

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

32.551G Biomechanics of Physical Rehabilitation **SS L2T1 C3**

Prerequisite: 32.510G or equivalent.

The application of biomechanics principles to the areas of: performance testing and assessment, physical therapy, design of rehabilitation equipment, design of internal and external prostheses and orthoses.

32.561G Mechanical Properties of Biomaterials **SS L2T1 C3**

Prerequisite: 32.510G or equivalent.

The physical properties of materials having significance to biomedical engineering: human tissues; skin; soft tissues; bone; metals; polymers and ceramics: the effects of degradation and corrosion.

32.611G Medical Instrumentation **S2 L2T1 C3**

Prerequisite: 32.040G or equivalent.

A critical survey of the theory and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories.

32.621G Biological Signal Analysis **S1 L3 C3**

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

32.701G Dynamics of the Cardiovascular System **S1 L2T1 C3**

Structure of the heart; organization of the mammalian vasculature; mechanical, electrical and metabolic aspects of cardiac pumping; the fluid mechanics of blood vessels.

Building

35.426G Building Services **L3 C3**

Prerequisite: Nil.

A study of thermal, electrical, hydraulic and mechanical services in buildings with regard to flexibility, space usage, long-term efficiency, design life and economy.

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 transmisson through building elements; noise components of environmental impact statements.

Biotechnology

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 systems; 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 anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, b-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.

42.214G 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 fermenter 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.

Safety Science

47.010G Basic Fortran C2

Introduction to computer programming using FORTRAN for people with no computer experience and no mathematical training beyond High School mathematics. Practice at programming and debugging, with problems taken from both data processing and scientific applications. Input and output FORMAT statements; nested DO loops; arithmetic statement functions; matrix arrays; implied DO loops; function subprograms and subroutine programs; sorting and merging techniques; common storage; communicating with peripherials of microcomputer; program planning and debugging.

47.015G Programming in BASIC C2

A brief introduction to programming, programming in BASIC on common microcomputers and Cyber 171, definition of programming problems using flowcharts, error diagnosis and debugging techniques, tab function, nested subroutines and FOR NEXT loops, sorting and comparision of strings and arrays, operations on 2-dimensional arrays, plotting, memory limitations.

47.031G Linguistics and Written and Spoken Communication C1

The lectures in linguistics aim to display the present state of linguistic theory in its aspects that relate most directly to human communication in the English-speaking world. Includes the structure of English sentences in terms of pragmatics, semantics, syntax, and phonology. The orientation is eclectic, and encompasses at least the traditional, the structural and the transformational-generative approaches. Stress on applications of linguistics, especially in language teaching, in technological developments for speech transmission, and in speech and language disorders. Students are expected to develop their own special interests.

47.032G Basic Information Theory C1

Nature and description of information. Measurement of information flow. Information content of printed, audio and video signals. Concept and measurement of redundancy. Signals in the presence of noise and crosstalk. Entropy and mutual information. Coding. Neurological model theories. Feedback and information flow in the human nervous system. Information storage and retrieval.

47.034G The Psychology of Communication C2

The basic communication process analysed in terms of Source, Medium/Message, Respondent and Effects. A social context theory of communication relating the influence of groups, roles, social class, power, status etc on communication. Attitude change through communication. Statistics and statistical analyses in the experimental study of communication.

47.038G The Body in Communication C1

Transmission of nerve impulse. Synoptic and muscular transmission. Reflex action. Sensation. Mechanism and characteristics of the ear. Mechanism and characteristics of the eye. Vision deflects and illusions. Organization of motor system. Neurological signal transmission characteristics. Speech. Neurological basis of mind and brain.

47.043G Presentation of Information C1

Styles, terms and models in communication. Channels of communication, audio and video. Characteristics of the various media of communication. Production and presentation of information by audio and video displays. Radio, films and TV for education. The actor in communication.

47.051G Principles of Solid Mechanics C3

The principles of the mechanics of solid bodies: force systems; kinematics and kinetics of rigid bodies; stress-strain relationships; stress analysis of simple elements.

47.052G Introduction to Safety Engineering C3

Management of dangerous materials; fire and explosion; ventilation; occupational toxicology; noise control; radiation protection; electrical safety; microbiological safety; failure of structures and machines.

47.054G Machines and Structures Safety C3

Machinery contact dangers; machine guarding. Deformation failures; fracture; failure of pressure vessels, lifting equipment, excavations, scaffolding. Deterioration due to wear, corrosion, fire. Inspection and control (including non-destructive testing). Maintenance and reliability.

47.060G Electrical Safety C3

Electric current; effects of current flow and electric fields; elementary circuit representation, typical supply situations; likely dangerous conditions; static electricity; hazardous location; some special problem areas; codes of safe working; treatment of electric shock.

47.070G Ventilation C3

Prevention of ventilation problems by process change, substitution, isolation, segregation, housekeeping. *Ventilation:* basic principles, air cleaning, recirculation, dilution, maintenance, safety considerations. *Airborne emissions:* dusts, gases, fumes, aerosols. General industrial control; dispersion, air cleaning, specific industry problems.

47.120G Human Behaviour and Safety Science C3

Industrial relations and implementation of a safety program. Learning and safety programs. Attitudes and attitude change. Safety compliance — individual and group factors affecting compliance. Work motivation and safety practice. Accident proneness and personnel selection. Individual differences in attitudes to work.

47.180G Management for Safety C3

Accounting; risk management; safety management and loss control; organization and management for safety; cost effectiveness of safety programs. Selection and training of personnel. Communication; modes of communication; prepartion of safety and accident reports; presentation of evidence.

47.230G Radiation Protection **C3**

Radiation physics; radiation dosimetry; radiation biology; shielding and control of radiation; administration; waste management; emergency procedures; environmental impact, non-ionizing radiation. Special topics; practical work and site visit.

47.330G The Accident Phenomenon **C3**

Causes of accidents and defensive strategies; energy storage and transfer; risk benefit concepts; epidemiology of accidents; reduction of loss from accidental injury; human factors; the environment and accidents; system reliability and fault-tree analysis in the study and control of accidents; study of some major accidents; accident investigation and analysis; case studies in transport, industry, recreation and the home.

47.345G Active and Adaptive Circuits **C3**

Revision of discrete and distributed RC synthesis as a preliminary to the discussion of active elements embedded in RC networks. The synthesis of linear active RC systems (with controlled sources, negative immittance converters, gyrators, etc), including state-space methods. Sensitivity consideration and integrated realization. Nonlinear and time-variable circuits. Adaptive filters for equalization and echo cancelling. Circuit techniques for achieving reliability in integrated circuits.

47.480G Fire and Explosion **C2**

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 prevention and extinguishing, explosion relief. Fire research; insurance.

47.481G Management of Dangerous Materials **C3**

Introduction. Measurement of environmental concentration of gases and particulate hazardous materials. Atmospheric dispersion of gaseous and particulate materials. Protection against dangerous materials for operators and other personnel. Respiratory protection and protective clothing. Storage, handling and transport of flammable liquids, dangerous goods and cryogenic material. Storage and transport of compressed gases. Disposal of dangerous materials; incinerators; flare stacks, landfill, dispersal. Relevant legislation. Field excursion.

47.900G Introductory Law **C2**

The concept of law; the creation and interpretation of statutes; the judicial and court systems; locus standi; common law and equity; basic principles of legal liability (civil and criminal); basic principles of administrative law and the liability of the Crown; the common law of employment; statutory regulation of employment; compulsory arbitration of industrial disputes.

47.909G Project **C9**

47.918G Research Project **C18**

Anatomy

70.201G Introductory Functional Anatomy*

An overview of human anatomy with special reference to the effects of chemical and physical trauma under industrial conditions. Includes reference to the musculosketal system, nervous system, lungs, kidneys, liver, brain, eyes, ears, all of which may be affected by industrial trauma.

*Subject to approval.

Pathology

72.402G Principles of Disease Processes **S1 L3 C3**

Prerequisites: 73.111 or equivalent, 70.011C or equivalent.

The reaction of cells to injury, the inflammatory reaction; necrosis-vascular changes and infarction; reparative processes; fracture healing; neoplasia; reaction to implants; specific processes requiring prosthetic assistance.

Physiology and Pharmacology

73.111 Physiology 1A **F L2T4**

Prerequisites: 17.031 & 17.041; 2.121 & 2.131, or 2.141; 10.001 or 10.011 or 10.021 B & C. Excluded: 73.121, 73.011A. Co-requisite: 41.101.

Introduction to fundamental physiological principles, dealing first with basic cellular function in terms of chemical and physical principles, and, second, with the operation of the various specialized systems in the body, for example, the cardiovascular system, whose function it is to transport materials to and from the tissues of the body; the respiratory system which must maintain the exchange of oxygen and carbon dioxide between the atmosphere and the blood; the gastrointestinal system which enables food materials to be modified by digestion and absorbed into the circulation; the kidney which is involved in the regulation of body fluid and electrolyte balance and with the excretion of the waste products of metabolism; the endocrine system which releases chemical messengers, called hormones, that

are carried in the blood stream to regulate a great variety of body functions, eg metabolism and reproductive activity; the nervous system which by means of very rapidly propagated electrical impulses is responsible for all our movements, sensations, memories, emotions and consciousness itself. A substantial series of practical class experiments on these different areas of physiology is included in the course. This subject is taken by students enrolled in any of the Physiology programs.

Medicine

80.701G Occupational Disease — S2L3 C3

Physical environment and disease: Musculoskeletal system, physical trauma; heat and cold, burns, electric shock; radiation; pressure, vibration, noise, hearing. *Chemical environment and disease:* Metallic poisons, toxic compounds, gaseous poisons, carcinogens, allergens. *Microbial environment and disease.*

Systems approach: Gastrointestinal tract; renal system; central and peripheral nervous systems; visual system, respiratory system, airborne particulates; skin.

80.702G Occupational Health Control — SSL3 C3

Introduction; dose response; risk, codes of safe practice; protection of the worker; design of safe workplace; protective equipment; occupational health surveillance; epidemiology; occupational safety program; emergency arrangements; environmental health; non-occupational safety; safety services.

Graduate Study

Conditions for the Award of Higher Degrees

First Degrees

Rules, regulations and conditions for the award of first degrees are set out in the appropriate **Faculty Handbooks.**

For the list of undergraduate courses and degrees offered see **Disciplines of the University: Faculty (Undergraduate Study)** in the Calendar.

Higher Degrees

The following is the list of higher degrees and graduate diplomas of the University, together with the publication in which the conditions for the award appear.

For the list of graduate degrees by research and course work, arranged in faculty order, see **Disciplines of the University: Table of Courses (by faculty): Graduate Study** in the Calendar.

For the statements **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.

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine	MD	Calendar Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Arts	MA	Arts Military Studies
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture

	Title	Abbreviation	Calendar/Handbook
Higher Degrees (continued)	Master of the Built Environment Master of the Built Environment (Building Conservation)	MBEnv	Architecture
	Master of Business Administration	MBA	AGSM
	Master of Chemistry	MChem	Sciences*
	Master of Commerce (Honours)	MCom(Hons)	Commerce
	Master of Commerce	MCom	Commerce
	Master of Education	MEd	Professional Studies
	Master of Educational Administration	MEdAdmin	Professional Studies
	Master of Engineering **Master of Engineering *without supervision***	**ME**	Applied Science **Engineering** Military Studies
	Master of Engineering Science	**MEngSc**	**Engineering** Military Studies
	Master of Environmental Studies	MEnvStudies	Applied Science
	Master of General Studies	MGenStud	General Studies
	Master of Health Administration	MHA	Professional Studies
	Master of Health Personnel Education	MHPEd	Medicine
	Master of Health Planning	MHP	Professional Studies
	Master of Industrial Design	MID	Architecture
	Master of Landscape Architecture	MLArch	Architecture
	Master of Laws	LLM	Law
	Master of Librarianship	MLib	Professional Studies
	Master of Mathematics	MMath	Sciences*
	Master of Nursing Administration	MNA	Professional Studies
	Master of Optometry	MOptom	Sciences*
	Master of Paediatrics	MPaed	Medicine
	Master of Physics	MPhysics	Sciences*
	Master of Psychology	MPsychol	Sciences§
	Master of Public Administration	MPA	AGSM
	Master of Safety Science	**MSafetySc**	**Engineering**
	Master of Science **Master of Science *without supervision***	**MSc**	Applied Science Architecture **Engineering** Medicine Military Studies Sciences*§
	Master of Science (Acoustics)	MSc(Acoustics)	Architecture
	Master of Science and Society	MScSoc	Sciences*
	Master of Science (Biotechnology)	MSc(Biotech)	Sciences§
	Master of Science (Building)	MSc(Building)	Architecture
	Master of Science (Industrial Design)	MSc(IndDes)	Architecture

Title	Abbreviation	Calendar/Handbook	
Master of Science (Psychology)	MSc(Psychol)	Sciences§	**Higher Degrees (continued)**
Master of Social Work	MSW	Professional Studies	
Master of Statistics	MStats	Sciences*	
Master of Surgery	MS	Medicine	
Master of Surveying **Master of Surveying *without supervision***	**MSurv**	**Engineering**	
Master of Surveying Science	**MSurvSc**	**Engineering**	
Master of Town Planning	MTP	Architecture	
Graduate Diploma	**GradDip**	Applied Science Architecture **Engineering** Sciences*§	**Graduate Diplomas**
	DipFDA	Sciences*	
	DipEd	Professional Studies	
	DipIM-ArchivAdmin		
	DipIM-Lib		

*Faculty of Science.
§Faculty of Biological Sciences.

Doctor of Philosophy (PhD)

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.

Qualifications

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.

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 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.

*Or department where a department is not within a school.

(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 one calendar year 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.

Thesis

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;

(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 satisified 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.

Examination

5. (1) There shall be not fewer than three examiners of the thesis, appointed by the Professorial Board on the recommendation of the Committee, at least two of whom shall be external to the University.

(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. **Fees**

1. The degree of Master of Biomedical Engineering may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study. **Master of Biomedical Engineering (MBiomedE)**

2. (1) An applicant for registration for the degree shall have been admitted to an appropriate Bachelor degree in the University of New South Wales or other university or tertiary institution at a standard acceptable to the Committee. **Qualifications**

(2) In exceptional cases an applicant may be registered as a candidate for the degree by submitting evidence of such academic and professional attainments as may be approved by the Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by completing a qualifying program as determined by the Committee.

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two months before commencement of the session in which the candidate desires to commence. **Registration**

(2) An approved candidate shall register in one of the following categories:

(a) student in full-time attendance at the University;

(b) student in part-time attendance at the University.

(3) A candidate for the degree shall be required to undertake such formal courses of study and pass such examinations as may be prescribed by the Committee and shall undertake a specified project, the satisfactory completion of which shall be regarded as part of the examination.

(4) 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 terminate candidature or take such other action as it considers appropriate.

*Or department where a department is not within a school.

(5) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of two full-time sessions after registration, or the equivalent in part-time study.

(6) The program of advanced study, including the preparation of a project report, shall normally total 60 credits. The humber of credits allocated to each subject shall be determined by the Committee on the recommendation of the director of the Centre for Biomedical Engineering. Students with advanced standing may be given limited exemptions by the Committee on the recommendation of the Director of the Centre.

(7) The project report will normally carry 18 credits weighting except in special cases, approved by the Director of the Centre, where a more detailed project report may carry a weighting of 30 credits towards the award of the degree.

Project Report

4. (1) The project forming the basis of the report shall be conducted under a supervisor(s) approved by the Committee on the recommendation of the Director of the Centre by Biomedical Engineering.

(2) Every candidate who submits a project report as provided in paragraph **3.** (3) shall submit three copies in a form which complies with the requirements of the University for the preparation and submission of higher degree theses and project reports. The candidate may also submit any work the candidate has published whether or not such work is related to the project report.

(3) For each candidate who submits a project as provided in paragraph **3.** (3) there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall, if possible, be an external examiner.

(4) It shall be understood that the University retains the three copies of the project report submitted for examination and is free to allow the report to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report in whole or in part, in photostat or microfilm or other copying medium.

Recommended for Admission to Degree

5. Having considered the examiners' reports and the candidate's other results in the prescribed course of study, the Committee shall recommend whether the candidate may be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME)

1. The degree of Master of Engineering may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an investigation.

Qualifications

2. (1) An applicant for registration for the degree shall have beem admitted to the degree of Bachelor in the University of New South Wales, or other approved university or tertiary institution, in an appropriate school or department at a standard acceptable to the Committee.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments, as may be approved by the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case, before permitting an applicant to register as a candidate, the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(c) student working externally to the University

(4) Every candidate for the degree shall be required to carry out a program of advanced study to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine. At least once a year and at any other time that the Committee sees fit, the candidate's supervisor shall present to the head of the school in which the candidate is registered, a report on the progress of the candidate. The Committee shall review the report and may, if it decides as a result of its review that the progress of the candidate is unsatisfactory, cancel registration or take such other action as it considers appropriate.

(5) No candidate shall be considered for the award of the degree until the lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may, with the approval of the Committee, be reduced by up to two sessions.

(6) A full-time candidate for the degree shall present for examination not later than eight academic sessions from the date of enrolment. A part-time or external 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.

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work the candidate has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Committee one of whom shall, if possible, be an external examiner.

(3) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Recommendation for Admission to Degree

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering Science (MEngSc) and Master of Surveying Science (MSurvSc)

1. The degrees of Master of Engineering Science and Master of Surveying Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor with Honours in the University of New South Wales or other approved university or tertiary education institution of acceptable standing in an appropriate school or department.

(2) The Committee may also admit a graduate with a pass degree of good standing from an appropriate degree course whose record is at a standard acceptable to the Committee.

(3) In special circumstances a person may be permitted to register as a candidate for the degree by submitting evidence of such academic and professional attainments as may be approved by the Committee.

(4) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two full calendar months before the commencement of the course.

(2) An approved candidate shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(3) A candidate for the degree shall:

(a) complete a program of advanced study which may include the submission of a report on a project based upon a design or a critical review; or

(b) demonstrate ability to carry out research by the submission of a thesis embodying the results of an original investigation; or

(c) complete an approved combination of the above.

(4) An applicant for registration shall indicate the proposed project area or major field of study in order that the responsibility for the supervision of the program may be determined.

(5) The approval of the appropriate Head of School for the proposed program must be obtained by the candidate prior to enrolment. For the purpose of this regulation the Head of School shall normally be the Head of the School providing supervision of the project or research or if there is no project the major field of study. Should the appropriate school be the School of Surveying the degree awarded shall be Master of Surveying Science.

(6) The program of advanced study including the preparation of a thesis or report on a project to be completed by each candidate shall total a minimum of 36 credits, the number of credits allocated for each subject being determined by the Committee on the recommendation of Heads of Schools. Where the formal course work comprises no more than 50% of the total study, or where the formal work comprises 50% or more but less than 100% the candidate shall be required to submit a report on a project. With the approval of the Head of School, candidates may take subjects from other Schools of the Faculty, other Faculties of the University and other universities or institutions.

(7) The project forming the basis for the report or thesis shall be conducted under a supervisor appointed by the Committee or under such conditions as the Committee may determine, to the satisfaction of the Head of School.

(8) Normally a candidate shall not be considered for the award of the degree until the lapse of two sessions in the case of a full-time candidate or four sessions in the case of a part-time candidate from the date of registration. The maximum period of candidature shall be four academic sessions from the date of registration for a full-time student and eight academic sessions for a part-time student. In special cases an extension of time may be granted by the Committee.

Thesis/Project

4. (1) Every candidate who submits a thesis (36 credits) as provided in paragraph **3.** (3) (b) shall submit three copies in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may also submit any published work whether or not such work is related to the thesis. The format of the report on a project as provided in paragraph **3.** (3) (a) shall comply with the requirements of the Faculty for the preparation and submission of project reports.

(2) For each candidate who submits a thesis or 18 credit project report there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall, if possible, be an external examiner.

(3) It shall be understood that the University retains the three copies of the thesis or 18 credit project report submitted for examination and is free to allow it to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue it in whole or in part, in photostat or microfilm or other copying medium.

(4) The report on the project (9 credits) provided in paragraph **3.** (3) (a) shall be under the supervision of a member of the academic staff and shall be examined by two examiners. The satisfactory completion of the project shall be regarded as part of the annual examinations.

5. Having considered the examiners' reports and the candidate's other work in the prescribed course of study the Committee shall recommend whether or not the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Fees

1. The degree of Master of Safety Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

Master of Safety Science (MSafetySc)

2. (1) An applicant for registration for the degree shall have been admitted to an appropriate Bachelor degree in the University of New South Wales, or other university or tertiary institution at a standard acceptable to the Committee.

Qualifications

(2) In exceptional cases an applicant may be registered as a candidate for the degree if the applicant submits evidence of such academic and professional attainments as may be approved by the Committee.

(3) Notwithstanding any other provisions fo these conditions the Committee may require an applicant to demonstrate fitness for registration by completing a qualifying program as determined by the Committee.

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two months before the commencement of the session in which the candidate desires to commence.

Registration

(2) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(3) A candidate for the degree shall be required to undertake such formal courses of study and pass such examinations as may be prescribed by the Committee including the submission of a report on a project based on a design or a critical review, the satisfactory completion of which shall be regarded as part of the examination.

(4) 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 terminate candidature or take such other action as it considers appropriate.

(5) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of two full-time sessions after registration, or the equivalent in part-time study.

(6) The program of advanced study, including the preparation of a report on a project shall normally total 54 credits. The number of crdits allocated to each subject shall be determined by the Committee on the recommendation of the Course Director. Students with advanced standing may be given limited exemption by the Committee on the recommendation of the Course Director.

4. (1) The report on the project (9 credits) provided in paragraph **3.** (3) shall be under the supervision of a member of the academic staff recommended by the Course Director and shall be examined by two examiners. The satisfactory completion of the project shall be regarded as part of the annual examinations.

Project

5. Having considered the examiners' reports and the candidate's other results in the prescribed course of study, the Committee shall recommend whether the candidate should be admitted to the degree.

Recommendation for Admission to Degree

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc)

1. The degree of Master of Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty or Board of Studies (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved university or tertiary institution in an appropriate school or department at a standard acceptable to the committee.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments as may be approved by the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree of Master of Science shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case before permitting an applicant to register as a candidate the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University;

(b) student in part-time attendance at the University;

(c) student working externally to the University.

(4) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an original investigation or design, to take such examinations and to perform such other work as may be prescribed by the Committee. This work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) At least once a year and at any other time that the Committee sees fit, the candidate's supervisor shall present to the head of school or department in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and may, if it decides as a result of its review that the progress of a candidate is unsatisfactory, cancel registration or take such other action as it considers appropriate.

(6) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of four complete sessions from the date of registration, save that the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may be reduced by up to two sessions with the approval of the Committee. A candidate who is fully engaged in research for the degree shall present for examination not later than six academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the Committee.

Thesis

4. (1) A candidate for the degree be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit also for examination any work he has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners, appointed by the Professorial Board on the recommendation of the Committee, one of whom, if possible, shall be external to the University.

(3) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the

provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part in photostat or microfilm or other copying medium.

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Fees

1. Where it is not possible for candidates to register under the normal conditions for the degree of Master of Science, Master of Engineering or Master of Surveying by reason of their location at centres which are distant from University Schools or where effective supervision is not practicable registration may be granted in these categories under the following conditions:

Master of Science (MSc) Master of Engineering (ME) Master of Surveying (MSurv) *without supervision*

2. An applicant for registration shall have been admitted to a degree of Bachelor in the University of New South Wales at a standard acceptable to the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee).

Qualifications

3. (1) An application to register as an external candidate for the degree of Master of Science, Master of Engineering or Master of Surveying without supervision shall be lodged with the Registrar for recommendation by the Head of School and consideration by the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his or her own interest at an early stage, seek the advice of the appropriate School with regard to the adequacy of the subject matter for the degree. A synopsis of the work should be enclosed.

Registration

(2) A candidate shall not be considered for the award of the degree until the lapse of six sessions in the case of honours graduates and eight sessions in the case of pass graduates from the date of graduation.

4. (1) (a) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an investigation or design. The thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. A candidate may submit also for examination any work the candidate has published, whether or not such work is related to the thesis.

Thesis

(b) Every candidate shall submit with the thesis a statutory declaration that the material contained therein is the candidate's own work, except where otherwise stated in the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall be an internal examiner.

(3) If the thesis reaches the required standard, the candidate shall be required to attend for an oral examination at a time and place nominated by the Committee. The examiners may also arrange at their discretion for the examination of the candidate by written and/or practical examinations on the subject of the thesis and/or subjects related thereto.

(4) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved applicant shall pay such fees as may be determined from time to time by the Council.

Fees

Master of Surveying (MSurv)

1. The degree of Master of Surveying may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to carry out research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) An application for registration for the degree shall have been admitted to the degree of Bachelor with Honours in the University of New South Wales or other approved university or tertiary education institution of acceptable standing in an appropriate school or department.

(2) The Committee may also admit a graduate with a pass degree of good standing from an appropriate degree course whose record is at a standard acceptable to the Committee.

(3) In special circumstances a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments as may be approved by the Committee.

(4) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case before permitting an applicant to register as a candidate the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University;

(b) student in part-time attendance at the University;

(c) student working externally to the University.

(4) Every candidate for the degree shall be required to carry out a program of advanced study, to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) No candidate shall be considered for the award of the degree until a lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may, with the approval of the Committee, be reduced by up to two sessions.

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work the candidate has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Committee, one of whom shall, if possible, be an external examiner.

(3) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Fees

Graduate Diploma

Graduate Diploma (GradDip)

1. An application for admission to a graduate diploma course shall be made on the prescribed form which should be lodged with the Registrar at least two full calendar months before the commencement of the course.

2. An applicant for admission to a graduate diploma course shall be:

(1) a graduate of the University of New South Wales or other approved university; or,

(2) a person with other qualifications as may be approved by Faculty.

3. Notwithstanding clause **2.** above, Faculty may require an applicant to take such other prerequisite or concurrent studies and/or examinations as it may prescribe.

4. Every candidate for a graduate diploma shall be required to undertake the appropriate course of study, to pass any prescribed examinations, and if so laid down in the course, to complete a project or assignment specified by the Head of the School. The format of the report on such project or assignment shall accord with the instructions laid down by the Head of the School.

5. An approved applicant shall be required to pay the fee for the course in which the applicant desires to register. Fees shall be paid in advance.

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 within that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

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.

Donor	Value	Year/s of Tenure	Conditions
General			
Bursary Endowment Board*	$200 pa	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding $6000.
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060, immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Girls Realm Guild	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age 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.
W. S. and L. B. Robinson**	Up to $3500 pa	1 year renewable for the duration of the course subject to satisfactory progress	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.
Universities Credit Union	$500 pa	1 year with the possibility of renewal	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.
Electrical Engineering			
The Tyree Electrical Company Pty Ltd	Up to $6720 over 4 years	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to the full-time degree course in Electrical Engineering
Mechanical Engineering			
The Fox Manufacturing Company	Up to $1500 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to the full-time degree course in Mechanical Engineering
James Howden & Co Australia Pty Ltd	Up to $400 pa	1 year	Permanent residence in Australia and eligibility for admission to the full-time degree course in Mechanical Engineering
Shell Refining Australia Pty Ltd	Up to $800 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to Year 2 of the full-time degree course in Mechanical Engineering

**Applications close 30 September each year.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Surveying			
The Institution of Surveyors, NSW Division	Up to $1000 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Surveying

Graduate Scholarships

Application forms and further information are available from the Student Enquiry Counter, located on the Ground Floor of the Chancellery. Information is also available on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

The following publications may also be of assistance: **1.** *Awards for Postgraduate Study in Australia* and *Awards for Postgraduate Study Overseas*, published by the Graduate Careers Council of Australia, PO Box 28, Parkville, Victoria 3052; **2.** *Study Abroad*, published by UNESCO*; **3.** *Scholarships Guide for Commonwealth Postgraduate Students*, published by the Association of Commonwealth Universities*.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Postgraduate Scholarships	Living allowance of $6150 pa. Other allowances may also be paid.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates (or equivalent). Applications to Dean of relevant Faculty.
Commonwealth Postgraduate Research Awards			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 Registrar by 31 October.
Commonwealth Postgraduate Course Awards	Living allowance of $7330 pa. Other allowances may also be paid.	1-2 years; minimum duration of course	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 Registrar by 30 September.
Australian American Educational Foundation Travel Grant (Fulbright)**			Applicants must be graduates, senior scholars or post-doctoral Fellows. Applications close 30 September.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women

*Available for reference in the University Library.
**Application forms are available from The Secretary, Department of Education, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Caltex Woman Graduate Scholarships	Six State awards of $5000 each One National award valued at $20,000 pa for study at an approved overseas institution.	1 year 2 years	Applicants must be female graduates who will have completed a University degree or diploma this year and who are Australian citizens or have resided in Australia for at least seven years. Selection is based on scholastic and literary achievements, demonstrable qualities of character and accomplishments in cultural and/or sporting/recreational activities. Applications close 30 September.
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	Applicants must be graduates who are Australian citizens and who are not older than 35 years of age. Applications close with Registrar by 15 September.
The English-Speaking Union (NSW Branch)	$2000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia.
Frank Knox Memorial Fellowships at Harvard University	Stipend of US$6000 pa plus tuition fees	1, sometimes 2 years	Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian university
Gowrie Scholarship Trust Fund	$3500 pa. Under special circumstances this may be increased.	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War. Applications close with Registrar by 31 October.
Harkness Fellowships of the Commonwealth Fund of New York**	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	12 to 21 months	Candidates must be: **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 15 August.

**Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, GPO Box 3947, Sydney, NSW 2001. These must be submitted to the Registrar by early August.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Rhodes Scholarship*	Approximately £3480 stg pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens aged between 19 and 25 who have been domiciled in Australia at least 5 years and have completed at least 2 years of an approved university course. Applications close in early September each year.
Rothmans Fellowships Award**	$17000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applicants must have at least 3 years graduate experience in research. Applications close in July.
Sam Cracknell Memorial	Up to $3000 pa		See above under **Undergraduate Scholarships, *General***
Engineering			
Australian Institute of Nuclear Science and Engineering Studentships	Basic stipend $9163 pa. Dependent spouse allowance $2220 pa, $520 for each dependent child, plus some University expenses.	1-3 years	Applicants must be honours graduates in Science or Engineering. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW. Applications close early November.
Harold G. Conde Memorial Fellowship	$7850 pa plus allowances	Maximum of 3 years	Applicants should be honours graduates permanently domiciled in Australia. The Fellowship is for graduate study or research in a field related to the electricity industry.
IBM Research Scholarship in Microelectronics	$11850 pa where only scholarship held. $5000 pa where it supplements another scholarship.	Up to 3 years	To enable a suitable graduate to undertake a research degree in the Joint Microelectronics Research Centre. Applications close 31 October.

*Applications to Mr H. McCredie, Secretary of the NSW Committee, University of Sydney, NSW 2006.
**Applications to the Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Engineering (continued)			
The Joseph Barling Fellowship	Not less than $8500	Maximum of 3 years	Candidates should be electrical engineering graduates of the University of New South Wales (in special circumstances mechanical and industrial engineering graduates may apply). The Fellowship is for full-time study for the award of the degree of Master of Business Administration or Doctor of Philosophy at the University. Applications close 30 November.
Shell Scholarship in Science or Engineering	See below under **Science**		

Prizes

Undergraduate University Prizes

The following table summarizes the undergraduate prizes for this Faculty awarded by the University. Prizes which are not specific to any School are listed under General.

Information regarding the establishment of new prizes may be obtained from the Examinations Section located on the Ground Floor of the Chancellery.

Donor/Name of Prize	Value $	Awarded for
General		
Sydney Technical College Union Award	150.00 and medal	Leadership in the development of student affairs, and academic proficiency throughout the course
University of New South Wales Alumni Association	Statuette	Achievement for community benefit – students in their final or graduating year
Faculties of Engineering and Applied Science		
Institution of Engineers, Australia	Medal and 100.00	The most proficient final year (or last 2 years part-time) student in the Bachelor of Engineering (or Bachelor of Science (Engineering)) degree courses offered by the following Schools: Civil Engineering Electrical Engineering and Computer Science Mechanical and Industrial Engineering Chemical Engineering and Industrial Chemistry Mining Engineering Textile Technology (Engineering option only)

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering		
Association of Consulting Structural Engineers of New South Wales	100.00	General proficiency – Structures in full-time final year of the Bachelor of Engineering degree course in Civil Engineering
	100.00	General proficiency – Structures in part-time final stage of the Bachelor of Science (Technology) degree course in Civil Engineering
Australian Conservation Foundation	50.00	Outstanding performance in subjects which develop environmental management concepts
Australian Welding Institute	Textbooks to the value of 30.00	Best design using a welding process for students in Years 2, 3 or 4
Chamber of Manufactures of New South Wales	50.00	Subject selected by Head of School
Crawford Munro Memorial	150.00	Highest proficiency in 8.582 Water Resources 2
Department of Civil Engineering Materials Staff	50.00	Best aggregate mark in the subjects: 8.2731 Geotechnical Engineering 1 8.2732 Geotechnical Engineering 2 8.2733 Rock Engineering 8.2741 Concrete Technology 8.2742 Metals Engineering
Hornibrook	200.00	Proficiency in Engineering Construction and Management
James Hardie Co Pty Ltd	225.00	Highest proficiency in 8.571 Hydraulics 1
Water Board Gold Medal	Medal	Public Health Engineering
School of Electrical Engineering and Computer Science		
Austral Crane	37.50	Bachelor of Engineering degree course in Electrical Engineering, Year 3
	37.50	Power or Control elective
Chamber of Manufactures of New South Wales	50.00	Subject selected by Head of School
Electricity Supply Engineers Association of New South Wales	100.00	Overall performance including proficiency in Electric Power Distribution in Year 3 full-time or equivalent part-time degree course
IBM	150.00	6.611 Computing 1
J. Douglas Maclurcan	40.00 Book order	Control Systems
The Wilfred Holmes Memorial Award	150.00	A student eligible to enter the final year of the degree course and who is deemed to be in necessitous circumstances

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Industrial Engineering		
Atlas Copco	125.00	General proficiency in Bachelor of Engineering degree course in Mechanical Engineering
Austral Crane	75.00	General proficiency in full-time Year 3 Mechanical Engineering
Australian Institute of Refrigeration, Air Conditioning and Heating	Student membership of the Institute for 1 year plus Design Aid and Data Book	Best performance in 5.624 Refrigeration and Air Conditioning
Babcock Aust Ltd	40.00	Subject selected by Head of School
David Carment Memorial	350.00 and medal	Highest proficiency in final year of Naval Architecture degree course
Chamber of Manufactures of New South Wales	50.00	Subject selected by Head of School
Computer-Based Engineering Design	75.00	Best undergraduate or graduate thesis making a contribution to Computer-Based Engineering Design in the School of Mechanical and Industrial Engineering
CSR Limited	60.00	Subject selected by Head of School
Ford Motor Co of Aust Ltd	100.00	
Harbin Polytechnical Alumni Association	100.00	Subject selected by Head of School
Jeremy Hirschhorn	20.00	Best performance by a final year student in theory of machines
Royal Institution of Naval Architects	50.00	Best ship design in the final year
Staedtler (Pacific) Pty Ltd	100.00 (open order)	General proficiency in Bachelor of Engineering degree course in Mechanical Engineering, Year 2
Department of Industrial Engineering		
Austral Crane	75.00	Bachelor of Engineering degree course in Industrial Engineering, Year 3
Chamber of Manufactures of New South Wales	50.00	Subject selected by Head of School
R. E. Jefferies Memorial	250.00	Performance in final year/stage of Bachelor of Engineering degree course in Industrial Engineering
TRW Australia Ltd	20.00	Bachelor of Science (Engineering) degree course in Industrial Engineering, Stage 6

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Surveying		
Association of Consulting Surveyors NSW	150.00	Most outstanding student in the field of land studies
Australian Photogrammatic Society	80.00	Subjects in photogrammetry including electives
Board of Surveyors Medal	Medal	Bachelor of Surveying degree course, Final Year
R. S. Mather Memorial	100.00	Most outstanding student in Geodesy

Graduate University Prizes

The following table summarizes the graduate prizes for this Faculty awarded by the University.

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering		
Institute of Advanced Motorists	20.00	Traffic Planning and Control
Wabco Aust Pty Ltd	400.00	Most distinguished graduate in the Master of Engineering Science degree course in Highway Engineering

Staff

Comprises Schools of Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Industrial Engineering, Nuclear Engineering, and Surveying; and Centre for Biomedical Engineering.

Dean

Professor N. L. Svensson

Chairman

Associate Professor D. T. Howell

Administrative Assistant

Patricia M. Rooney

Honorary Visiting Fellow

Colin Arthur Stapleton, BSc BE *Syd.*, CEng, MIEAust, MIEE, MIEEE

School of Civil Engineering

Professor of Civil Engineering, Head of School and of Department of Water Engineering

Thomas Grandin Chapman, BSc *Leeds*, PhD *S'ton.*, FIEAust, MACS

Professor of Civil Engineering and Head of Department of Engineering Construction and Management

Ronald William Woodhead, BE *Syd.*, ME *N.S.W.*, FIEAust, FAIB

Professor of Civil Engineering and Head of Department of Civil Engineering Materials

Vacant

Professor of Civil Engineering and Head of Department of Structural Engineering

Hilary Max Irvine, ME *Cant.*, CE *Caltech.*, PhD *Auck.*, MNZIE

Professor of Transport Engineering and Head of Department

John Andrew Black, BA *Manc.*, PhD *Brad.*, MTCP *Syd.*, MCIT

Senior Administrative Officer

Robert William Prior

Administrative Assistant

George John Harris, BA *N.S.W.*

Visiting Fellow

Graeme Maxwell Peck, BE *Tas.*, FIEAust

Honorary Associate

Alexander Wargon, MSc *Harv.*, CE, FIEAust, FASCE, MNZIE

Department of Civil Engineering Materials

Includes Soil Mechanics, Rock Mechanics, Concrete Technology, Plastics and Timber, Pavement Engineering, Continuum and Statistical Mechanics, Metals and Welding Technology.

Associate Professors

David John Cook, BE *W.Aust.*, MSc PhD *Calg.*, MIEAust
Somasundaram Valliappan, BE *Annam.*, MS *Northeastern*, PhD DSc *Wales*, FIEAust, FASCE

Senior Lecturers

William Henry Cogill, MSc(Eng) *CapeT.*, MSc *Camb.*, PhD *N.S.W.*, FIEAust, MICE
Arthur William Manton-Hall, BE MEngSc PhD *N.S.W.*, MIEAust, LGE
Bruce John Francis Patten, BE *Syd.*, PhD *N.S.W.*, DIC *Lond.*
Brian Shackel, BE *Sheff.*, MEngSc PhD *N.S.W.*, MIEAust
John Maurice Wheatley, MA PhD *Camb.*, CEng, FIM, FAusWI, MWeldI(Lond)
William Otho Yandell, ME PhD *N.S.W.*, MIEAust
Stephen Ross Yeomans, BSc PhD *N.S.W.*, CEng, MIM

Lecturer

Harry Taylor, BSc(Eng) *Birm.*, DipNAAC *Syd.*, MIEAust

Professional Officers

Trinh Cao, BE *Monash*
Nam Lim, BE *Hanyang*, MSc PhD *N.S.W.*
Ghodratollah Tamaddoni, BEngAg *Tehran*, DrAgSc *Gembloux*

Analyst/Programmer

Damian McGuckin, BSc BE *Syd.*

Department of Engineering Construction and Management

Includes Systems Engineering, Engineering Economy, Project Planning and Management.

Senior Lecturers

Arthur Gordon Douglas, ME *N.S.W.*, PhD *Mich.State*, MIEAust
Graham Rush Easton, BSc BE *Syd.*, MEngSc *Birm.*, MIEAust, AIArbA
Robert Alexander Jones, BE *W.Aust.*, ME *Auck.*, MSc DIC *Lond.*, MIEAust, LS(NZ)
Jonathan Brian O'Brien, BE *N.S.W.*, MASc *Tor.*, MIEAust
Victor John Summersby, BE MEngSc MCom *N.S.W.*, ASTC, MIEAust

Professional Officers

John Laurence Knott, BE *N.S.W.*
Fredrick Adrian John Stein, ED, BE *N.S.W.*, GradIEAust, AMASCE

Programmer

Jane Nerida Knott, MSc DipEd *W'gong.*

Department of Structural Engineering

Includes Structural Analysis, Structural Design, Stress Analysis and Solid Mechanics.

Associate Professors

Algis Peter Kabaila, MEngSc PhD *N.S.W.*, FRMTC, MIEAust
Victor Andrada Pulmano, BSCE *Philippines*, MEng *A.I.T.*, PhD *Northwestern*
B. Vijaya Rangan, BE *Madr.*, PhD *I.I.S.B'lore.*, MIEAust, MIEIndia

Senior Lecturers

Donald John Fraser, MEngSc PhD *N.S.W.*, ASTC
Raymond Ian Gilbert, BE PhD *N.S.W.*, MIEAust
Alexander Cuthbert Heaney, BE MEngSc *Melb.*, PhD *Wat.*, MIEAust, MASCE, AMICE
Peter Walder Kneen, BE *Melb.*, PhD *Wat.*, MIEAust, IASS
Raymond Eric Lawther, BE PhD *N.S.W.*
Ian James Somervaille, BE PhD *N.S.W.*, ASTC

Lecturers

Francis Shay Khiet Tin Loi, BE PhD *Monash*, MIEAust
Neil Colin Mickleborough, MEng *Car.*, PhD *Tas.*, DipCE *HobartT.C.*, MIEAust, MASCE, MCSCE, RPEQ

Tutor

Mario Maria Paul Attard, BE *N.S.W.*

Professional Officer

John Wesley Carrick, BE *N.S.W.*

Department of Transport Engineering

Senior Lecturers

Alec James Fisher, BSc *Lond.*, PhD *N.S.W.*, FIESAust
Ross Donald Munro, BSc *W.Aust.*, BA *Melb.*, FSS
Theo ten Brummelaar, BE MEngSc *N.S.W.*, MIEAust
John Irwin Tindall, BE *Qld.*, BCom ME *N.S.W.*, MIEAust

Lecturer

Michael Clarence Dunne, BSc PhD *Adel.*

Professional Officers

Roger Roy Hall, BSc *A.N.U.*, MSc *N.S.W.*, FESANZ, MIESAust
Clement Edward Quinlan, GradDip N.S.W., ASTC, MIEAust
Andrzej Waldemar Raczkowski, Mgrinz *T.U.Warsaw*, MIEAust
Colin John Wingrove, BSc MEngSc *N.S.W.*

Department of Water Engineering

Includes Hydraulics, Hydrology, Public Health Engineering, Water Resources Engineering, and the Water Research Laboratory.

Associate Professors

David Barnes, BSc PhD *Birm.*, MIWSE, MIEAust, AMICE
Ian Cordery, ME PhD *N.S.W.*, MIEAust

Douglas Neil Foster, BE *Syd.*, MIEAust, MASCE
Bernard William Gould, BE *Tas.*, ME *N.S.W.*, MIEAust
David Trewhella Howell, BE *Syd.*, ME *N.S.W.*, MIEAust, MAIAS
David Herbert Pilgrim, BE PhD DSc *N.S.W.*, FIEAust
Keith Kingsford Watson, BE *Syd.*, ME PhD DSc *N.S.W.*, FIEAust

Senior Lecturers

Peter John Bliss, BE *N.S.W.*, MSc DIC *Lond.*, ASTC, MIEAust
Colin Raymond Dudgeon, ME *N.S.W.*, MIEAust, MASCE
Trevor Regis Fietz, ME *N.S.W.*
Brian Selby Jenkins, BE PhD *N.S.W.*, ASTC, MIEAust, LGE
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School of Electrical Engineering and Computer Science

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Professor of Computer Science

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Tyree Professor of Electrical Engineering — Electric Power Engineering

Vacant

Professor of Electrical Engineering — Electronics

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Visiting Professor — Solid State Electronics

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The Bao Vu, BE PhD *Adel.*, SMIEEE

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Professor of Mechanical Engineering and Head of Department of Agricultural Engineering

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Vacant

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Honorary Associate

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Department of Agricultural Engineering

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Jae Lin Woo, BSc *Seoul*, SM *M.I.T.*, PhD *N.S.W.*

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Department of Fluid Mechanics and Thermodynamics

Includes Aeronautical Engineering and Naval Architecture.

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†Lawrence Julian Doctors, BE MEngSc *Syd.*, PhD *Mich.*, MRINA, AMSNAME
†Owen Francis Hughes, SB SM(NavArch), *M.I.T.*, PhD *N.S.W.*, MIEAust, MRINA, MSNAME

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Lecturers

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Eddie Leonardi, BSc(Eng) PhD *N.S.W.*, MIEAust, MAIRAH, AMASHRAE
Ian Lachlan Maclaine-Cross, BE *Melb.*, PhD *Monash*, MIEAust

*Aeronautical Engineering
†Naval Architecture

Department of Industrial Engineering

Includes Operations Research and Production Engineering.

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Roger Malcolm Kerr, BSc *Lond.*, MSc *Bath*, DPhil *Oxf.*
Grier Cheng Lin, DipMechEng *P.T.I.T., Taiwan*, PhD *N.S.W.*, MIEAust
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Philip Mathew, BE PhD *N.S.W.*

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Professor of Nuclear Engineering and Head of School

James Joseph Thompson, BE PhD *Syd.*, FIEAust

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Senior Lecturers

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Professional Officer

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Honorary Visiting Fellow

John Gannon Clouston, MSc *Syd.*, PhD DIC *Lond.*, ASTC, FAIP

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Professor of Surveying (on leave)

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Associate Professors

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John Charles Trinder, BSurv PhD *N.S.W.*, MSc *I.T.C. Delft*, RegSurv(NSW), FISAust

Senior Lecturers

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Anthony John Robinson, BSurv MBA PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC
Jean Marc Rueger, DiplIng *E.T.H. Zurich*, PhD *N.S.W.*, SIA, LS(Switz), MISAust
Artur Stolz, BSurv PhD *N.S.W.*, RegSurv(NSW)
Ian Philip Williamson, BSurv MSurvSc PhD *N.S.W.*, RegSurv(NSW), MISAust

Lecturers

Pratap Shivabhai Amin, BSc *I.T.C. Delft*, MSc *Lond.*, MISK, CLSEA, ARICS
Leonard Berlin, BSc(LS) *CapeT.*, BSc *I.T.C. Delft*
Sabapathy Ganeshan, BSc *Ceyl.*,
Lynn Charles Holstein, DipPhotogram *U.C.L.*, RegSurv(NSW), ARICS
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Gregory John Williams, BSurv *N.S.W.*, RegSurv(*N.S.W.*), MISAust

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Tat Ming Lau, BE *N'cle.(N.S.W.)*

Analyst/Programmers

Mohammad Hadi Aghakhani, BSc *Sh.U.T. Tehran,*
MSc *Colorado State*
Bernd Hirsch

Visiting Professor

Wolfgang Faig, Dipl Ing Drlng *Stuttgart,* MSc *NewBr.*

Centre for Biomedical Engineering

Acting Director

Professor N. L. Svensson

Director

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PhD *Wash.*, DSc *N.S.W.*, MASAIO, MISAO

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*Edward Maxwell Nicholls, MD BS *Adel.*

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Klaus Schindhelm, BE PhD *N.S.W.*, MIEAust, MASAIO

Administrative Assistant

Rhonwen Mooney, BA DipSocWk *Syd.*

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Tibor Timothy Vajda, DDS *Bud.*, FRSM, FACBS

Honorary Associate

Bernard Bloch, MB CRB *Witw.*, FRCS

*Joint appointment with Faculty of Medicine.

The University of New South Wales Kensington Campus 1985

Theatres

Biomedical Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Rex Vowels Theatre F17
Keith Burrows Theatre J14
Main Building 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 (John Goodsell) F20
Dalton (Chemistry) F12
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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) F20
Kanga's House O14
Kensington Colleges C17 (Office)
Basser C18
Goldstein D16
Philip Baxter D14
Main Building K15
Maintenance Workshop B13
Mathews F23
Mechanical and
Industrial Engineering J17
Medicine (Administration) B27
Menzies Library E21
Metallurgy E8
Morven Brown (Arts) C20
New College (Anglican) L6
Newton J12
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
Wool and Pastoral Sciences B8

General

Academic Staff Office C22
Accountancy F20
Admissions C22
Adviser for Prospective Students C22
Alumni and Ceremonials C22
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Applied Science (Faculty Office) F10
Architecture
(including Faculty Office) H14
Arts (Faculty Office) C20
Audio Visual Unit F20
Australian Graduate
School of Management G27
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biomedical Library F23
Biotechnology D26
Bookshop G17
Botany D26
Building H14
Careers and Employment C22
Cashier's Office C22
Centre for Biomedical Engineering A28
Centre for Medical Education
Research and Development C27
Centre for Remote Sensing K17
Chaplains E15a
Chemical Engineering and
Industrial Chemistry F10
Chemistry E12
Child Care Centres N8, O14
Civil Engineering H20
Closed Circuit Television Centre F20
Commerce (Faculty Office) F20
Committee in Postgraduate Medical
Education B27
Community Medicine D26
Computing Services Unit F21
Drama B10
Economics F20
Education G2
Education Testing Centre E15d
Electrical Engineering and
Computer Science G17
Energy Research, Development and
Information Centre B8b
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English C20
Examinations C22
Fees Office C22
Food Technology F10
French C20
General Staff Office C22
General Studies C20
Geography K17
German Studies C20
Graduate School of the Built
Environment H14
Health Administration C22
History C20
History and Philosophy of Science C20
Industrial Arts H14
Industrial Engineering J17
Institute of Rural Technology B8b
Japanese Economic Management
Studies Centre G14
Kanga's House O14
Kindergarten (House at Pooh Corner) N8
Landscape Architecture K15
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Law Library F21
Librarianship F23
Library E21
Lost Property F20
Marketing F20
Mathematics F23
Mechanical Engineering J17
Medicine (Faculty Office) B27
Metallurgy E8
Microbiology D26
Mining Engineering K15
Music B11b
National Institute of Dramatic Art
C15 and D2
Nuclear Engineering J17
Off-campus Housing C22
Optometry J12
Organizational Behaviour F20
Pathology C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K15
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Recreation Centre (PERC) B5
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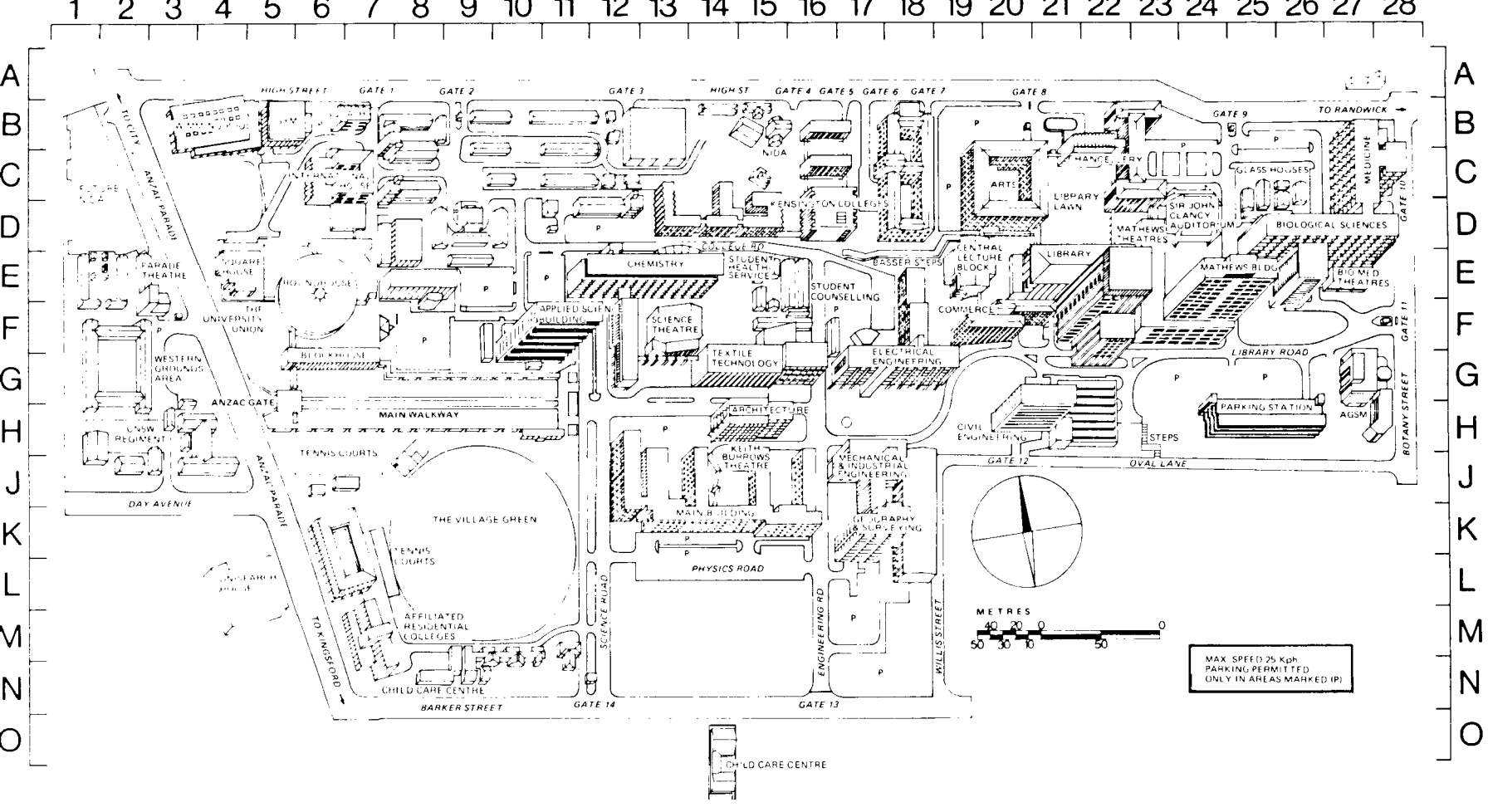
Political Science C20
Postgraduate Extension Studies F23
Psychology F23
Public Affairs Unit C22
Regional Teacher Training Centre C27
Russian C20
Science and Mathematics Course
Office F23
Social Work G2
Sociology C20
Spanish and Latin American Studies C20
Sport and Recreation E4
Student Counselling and Research E15c
Student Health E15b
Student Records C22
Students' Union E4 and C21
Surveying K17
Teachers' College Liaison Office F15b
Tertiary Education Research Centre E15d
Textile Technology G14
Town Planning K15
University Archives C22
University Press A28
University Union (Blockhouse) G6
Wool and Pastoral Sciences B8a
Zoology D26


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
A B C D E F G H J K L M N O
HIGH STREET
GATE 1
GATE 2
GATE 3
HIGH ST
GATE 4
GATE 5
GATE 6
GATE 7
GATE 8
GATE 9
TO RANDWICK
NIDA
KENSINGTON COLLEGES
ARTS
LIBRARY LAWN
GLASS HOUSES
MEDICINE
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
COLLEGE RD
CHEMISTRY
STUDENT HEALTH SERVICE
BASSER STEPS
LIBRARY
MATHEWS BLDG
BIO MED THEATRES
GATE 10
GATE 11
PARADE THEATRE
SQUARE HOUSE
THE UNIVERSITY UNION
APPLIED SCIENCE BUILDING
SCIENCE THEATRE
STUDENT COUNSELLING
COMMERCE
LIBRARY ROAD
BLOCKHOUSE
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
AGSM
UNSW REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
CIVIL ENGINEERING
STEPS
GATE 12
OVAL LANE
BOTANY STREET
MECHANICAL & INDUSTRIAL ENGINEERING
DAY AVENUE
THE VILLAGE GREEN
TENNIS COURTS
MAIN BUILDING
GEOGRAPHY & SURVEYING
PHYSICS ROAD
ANZAC PARADE
TO CITY
TO KINGSFORD
AFFILIATED RESIDENTIAL COLLEGES
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
CHILD CARE CENTRE
BARKER STREET
GATE 14
GATE 13
METRES
40 20 0 0
50 30 10 50
MAX SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)
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