The University of New South Wales

Engineering

1980 Faculty Handbook

How to use this Handbook

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

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

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

Faculty Information.

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

Graduate Study is about higher degrees.

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

Information includes:

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

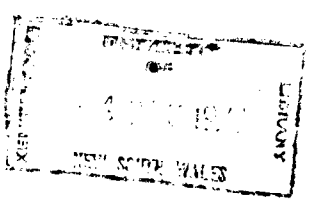
Financial Assistance to Students is a list of scholarships and prizes, available at undergraduate and graduate level in the faculty.

Staff list.

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

The University of New South Wales

Engineering



1980 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 1979, but may be amended without notice by the University Council

Contents

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 the University and its activities you should consult the University Calendar.

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 6630351 and ask for the extension or dial 662—and then the extension number. This prefix should only be used when you are certain of the extension that you require. Callers using 662 cannot be transferred to any other number.

Some people who can help you

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

The Deputy Registrar (Student Services), Mr Peter O'Brien, and his **Administrative Assistant,** Mrs Anne Beaumont, are located on the first floor of the Chancellery. They will help students who need advice and who have problems and are not sure whom they should see. As well as dealing with general enquiries they are especially concerned with the problems of physically handicapped and disabled students and those in need of financial assistance. The latter students should see Mrs Beaumont. Enquire at room 148E, phone 2482 (general enquiries) or 3164 (financial assistance).

The Assistant Registrar (Admissions and Higher Degrees), Mr Jack Hill, is located on the ground floor of the Chancellery. General enquiries should be directed to 3715.

The Assistant Registrar (Examinations and Student Records), Mr Peter Wildblood is located on the ground floor of the Chancellery. For particular enquiries regarding the Student Records Unit, including illness and other matters affecting

performance in examinations, academic statements, graduation ceremonies, prizes, release of examination results and variations to enrolment programs, phone 3711. For information regarding examinations, including examination timetables and clash of examinations, contact **the Administrative Officer**, Mr John Grigg, phone 2143.

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

The Assistant Registrar (Student Employment and Scholarships), Mr Jack Foley, is located in the Chancellery. Enquiries should be directed to 2086 (undergraduate scholarships), 2525 (graduate scholarships) and 3259 (employment).

The Housing Officer, Mrs Judy Hay, is located in the Student Amenities and Recreation Section in the huts at the foot of Basser Steps. For assistance in obtaining suitable lodgings phone 3260.

The Student Health Unit is located in Hut E at the foot of Basser Steps. The Director is Dr Max Napthali. For medical aid phone 2679 or 3275.

The Student Counselling and Research Unit is located at the foot of Basser Steps. For assistance with educational or vocational problems ring 3681, 3685 or 2696 for an appointment.

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

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

The Students' Union is located on the second floor of Stage III of the University Union, where the SU full-time President, Education Vice-President, Welfare-Research Officer, and Director of Overseas Students are available to discuss any problems you might have. In addition the SU offers a range of diverse services including legal advice (full-time solicitor available), clubs and societies services, second-hand bookshop (buy or sell), new records/tapes at discount, food shop (The Nuthouse), a professional nursery-kindergarten (House at Pooh Corner), a typesetting service, electronic calculators (bulk purchasing), an information referral centre (the Infakt Bus), a bail fund and publications such as *Tharunka*, Orientation Magazine, Concessions Book and counter-course handbooks. For information about these phone 2929.

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 session and there are short recesses of one week within each of the sessions.

Session 1 commences on the first Monday of March.

1980

Session 1	3 March to 11 May
(14 weeks)	*May Recess:* 12 May to 18 May
	19 May to 15 June
Tuesday	*Midyear Recess:* 16 June to 20 July
17 June	Examinations begin
Wednesday	
2 July	Examinations end
Session 2	21 July to 24 August
(14 weeks)	*August Recess:* 25 August to 31 August
	1 September to 2 November
Monday	
10 November	Examinations begin
Friday	
29 November	Examinations end

January

Tuesday 1	New Year's Day — Public Holiday
Friday 4	Last day for applications for review of results of *annual* examinations
Friday 11	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University
Monday 28	Australia Day — Public Holiday

February

Monday 4	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
	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out their degree for any other reason

March

Monday 3	**Session 1 commences**
Tuesday 4	List of graduands for April/May ceremonies and of 1979 prize-winners published in daily press
Friday 14	Last day for acceptance of enrolment by new undergraduate students (late fee payable)
Friday 28	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable)

April

Thursday 3	*Confirmation of Enrolment* forms despatched to all students
Friday 4 to Monday 7	Easter
Friday 18	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Friday 25	Anzac Day — Public Holiday

May

Monday 5	Last day for undergraduate students completing requirements for degrees or diplomas at the end of Session 1 to submit *Application for Admission to Degree* form
Monday 12	**May Recess begins**
Thursday 15	Publication of provisional timetable for June/July examinations
Sunday 18	**May Recess ends**
Friday 23	Last day for students to advise of examination timetable clashes

June

Tuesday 3	Publication of timetable for June/July examinations
Sunday 15	**Session 1 ends**
Monday 16	Queen's Birthday — Public Holiday
	Midyear Recess begins
Tuesday 17	Examinations begin

July

Wednesday 2	Examinations end
Tuesday 15	Examination results mailed to students
Wednesday 16	Examination results displayed on University noticeboards
Tuesday 15 to Friday 18	Students to amend enrolment programs following receipt of June examination results
Sunday 20	**Midyear Recess ends**
Monday 21	**Session 2 begins**
	Last day for application for review of June examination results
Thursday 31	Foundation Day (no classes held)

August

Friday 1	Last day for students to discontinue without failure subjects which extend over the whole academic year
Monday 25	**August Recess begins**
Sunday 31	**August Recess ends**

September

Friday 5	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Monday 8	Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit *Application for Admission to Degree* forms
Wednesday 10	List of graduands for October graduation ceremonies published in daily press
Friday 12	Last day for students to discontinue without failure subjects which extend over Session 2 only
	Confirmation of Enrolment form forwarded to all students

Monday 15	Last day to notify intention of attending October graduation ceremonies
Monday 22	Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit *Application for Admission to Degree* form
Friday 26	Last day for acceptance of corrected *Confirmation of Enrolment* forms

October

Wednesday 1	Last day to apply to UCAC for transfer to another university in New South Wales
Thursday 2	Publication of provisional examination timetable
Monday 6	Eight Hour Day — Public Holiday
Thursday 9	Graduation ceremonies
Friday 10	Last day for students to advise of examination timetable clashes
Thursday 21	Publication of timetable for examinations

November

Sunday 2	**Session 2 ends**
Monday 3	**Study Recess begins**
Sunday 9	**Study Recess ends**
Monday 10	Examinations begin
Saturday 29	Examinations end

December

Tuesday 16	Examination results mailed to students
Wednesday 17	Examination results displayed on University notice boards
Thursday 25	Christmas Day — Public Holiday
Friday 26	Boxing Day — Public Holiday

Organization of the University

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

In 1979 the University had 18,466 students and over 3,700 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W.S. and L.B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

Arms of the University of New South Wales

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

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

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

The Council

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

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

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

The Chairman of the Council is the Chancellor, the Hon. Mr Justice Samuels, and the Deputy Chancellor is Dr F.M. Mathews.

The Professorial Board

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

The Faculties/Boards of Study

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

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

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

The Schools

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

Executive Officers

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

He is assisted in this task by three Pro-Vice-Chancellors, Professor John Thornton, Professor Ray Golding and Professor Rex Vowels, together with the Deans and the three heads of the administrative divisions.

General Administration

The administration of general matters within the University comes mainly within the province of the Registrar, Mr Keith Jennings, the Bursar, Mr Tom Daly, and the Business Manager (Property), Mr R.K. Fletcher.

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

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

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

Student Representation on Council and Faculties/Boards

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

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

Open Faculty/Board Meetings

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

Award of the University Medal

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

Identification of Subjects by Numbers

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

Textbook Lists

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

General Studies Program

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

Student Services and Activities

The University Library

The University libraries are mostly situated on the upper campus. The main library building (Menzies Library) houses 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.

There are also library services at other centres:

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

The library at the Broken Hill Division in the W.S. and L.B. Robinson University College building. Phone Broken Hill (080) 6022.

The library at the Royal Military College, Duntroon ACT, serving the Faculty of Military Studies. Phone (062) 73 0427.

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

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

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.

Kensington Colleges

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

International House

International House accommodates 154 students from Australia and up to twenty other countries. Preference is given to more senior undergraduates and graduate students. Apply in writing to the Warden, International House, PO Box 88, Kensington, NSW 2033.

New College

This Church of England College is open to all students without regard to race or religion. It has accommodation for approximately 220 students and is co-educational. Enquiries should be addressed to the Master, New College, Anzac Parade, Kensington, NSW 2033.

Shalom College

Shalom College 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. A comprehensive tutorial program is offered along with a wide variety of activities and opportunities to meet informally with members of the University staff. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. Warrane is directed by the Catholic lay association Opus Dei. Apply in writing to the Master, Warrane College, PO Box 123, Kensington, NSW 2033.

Creston Residence

Creston Residence offers accommodation for 25 full-time undergraduate and graduate women students without restriction of denomination or nationality. Non-resident membership provides students with the opportunity to participate in the activities of the Residence and to make use of its facilities. Creston is directed by the Women's Section of Opus Dei, a Catholic lay association. Enquiries should be addressed to the Principal, 36 High Street, Randwick, NSW 2031.

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may contact the Housing Officer in the Student Amenities and Recreation Section for assistance in obtaining suitable lodging in the way of full board, room 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.

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, list of estate agents and hints on house-hunting are available on request.

Location: The Student Accommodation Service is located in the huts at the foot of Basser Steps. Phone 663 0351, extension 3260.

Student Employment and Scholarships

The Student Employment and Scholarships Section offers assistance with career employment for final year students and graduates of the University. This service includes the mailing of regular job vacancy notices to registered students, and a Careers Library containing information on various careers and employers.

Careers advice and assistance are also available to undergraduates. Students undertaking courses in Applied Science or Engineering which require course-related industrial or professional training experience are assisted to find such employment over the long vacation. Information and advice regarding cadetships and undergraduate and graduates scholarships is also available.

The service is located in the Chancellery.

Phone extension 3259 for employment and careers advice, extension 2525 for details of graduate awards and grants, and extension 2086 for undergraduate scholarship, cadetship and industrial training information.

Student Health

A student health clinic and first aid centre is situated within the University. It is staffed by three qualified medical practitioners, assisted by two nursing sisters. The medical service, although therapeutic, is not intended to entirely 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 for specialist opinion and/or treatment. 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 as well as first aid service in the case of injury or illness on the campus are available.

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

Appointments may be made by calling at the centre or by telephoning extension 2679 or 3275 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. These clinics are open to staff and students and appointments may be made for the Student Health Unit clinic by telephoning 698 9499, or for The Prince of Wales Hospital clinics by telephoning 399 0111.

Student Counselling and Research

The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, established and graduate. Self-help programs are also available. Opportunities are provided for parents and others concerned with student progress to see members of the counselling staff.

The service which is free, informal and personal is designed to help students with planning and decision making, and a wide variety of concerns and worries which may be affecting personal, educational and vocational aspects of their lives.

The Unit pursues research into factors affecting student performance, and the published results of its research and experience are helpful in improving University and other counselling services, and the quality of student life.

Counselling appointments may be arranged during sessions and recesses between 9 am and 7 pm. Phone 663 0351, extension 3681, 3685 and 2696, or call at the Unit which is located at the foot of Basser Steps. Urgent interviews are possible on a walk-in basis between 9 am and 5 pm. Group counselling programs are offered both day and evening between 9 am and 9 pm by special arrangement. Self-help programs are arranged to suit the student's time and convenience.

Student Amenities and Recreation

In general the Student Amenities and Recreation Section seeks ways to promote the physical, social and educational development of students through their leisure time activities and to provide some services essential to their day-to-day University life.

The Section provides, for example, a recreational program for students and staff at the Physical Education and Recreation Centre; negotiates with the Public Transport Commission of NSW on student travel concessions and supplies concession forms for bus, rail, ferries and planes; assists students with off-campus housing; makes bookings for use of sports facilities; and, in consultation with the Sports Association, assists various recognized clubs.

The Section is located in the huts at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Recreation Program 3271; Travel 2617; Accommodation 3260; Ground Bookings 2235; Sports Association 2673.

Physical Education and Recreation Centre

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

The Sports Association

The Sports Association caters for a variety of competitive sports for both men and women. Membership is compulsory at $11 per year for all registered students and is open to all members of staff and graduates of the University.

The Sports Association office is situated in the huts at the foot of Basser Steps, and the control of the Sports Association is vested in the General Committee. The Sports Association may be contacted on extension 2673.

Student Travel Concessions

The Student Amenities and Recreation Section arranges distribution of bus, rail and ferry concessions. For the peak period during the week preceding and the first week of Session 1 distribution is at a location to be decided. Students should watch for notices around the campus announcing the distribution centre.

For the rest of the year students seeking authorization for travel concessions, including planes, should enquire at the section (extension 2617) or the Enquiry Desk, Chancellery (extension 2251).

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 (Stage 2) and the Squarehouse (Stage 3). Membership of the Union is compulsory at $55 per year for all registered students and is open to all members of staff and graduates of the University.

The full range of facilities provided by the Union includes a cafeteria service and other dining facilities, a large shopping centre, cloak room, banking and hairdressing facilities, showers, a women's lounge, common, games, reading, meeting, music, practice, craft and dark rooms. Photocopying, sign printing, and stencil cutting services are also available. The Union also sponsors special concerts (including lunchtime concerts) and conducts courses in many facets of the arts including weaving, photography, creative dance and yoga. Exhibitions are held in the John Clark Gallery.

Full information concerning courses is contained in a booklet obtainable from the Union's Program Department.

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

The Students' Union

The Students' Union is run by students and represents them on and off campus. Presidential elections are by popular vote and all students who have completed one year at the University are eligible for election. The President directs the entire administration of the Students' Union and its activities.

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

Membership is compulsory at $17 per annum for full-time students and $13 for part-time students.

The activities of the Students' Union include:

1. Infakt: a student-run information referral service. If you want someone to talk to or need help of any kind see the people at Infakt located in the bus at the foot of Basser Steps.
2. A casual employment service.
3. Organization of Orientation Week.
4. Organization of Foundation Day.
5. A nursery/kindergarten, *The House at Pooh Corner.*
6. Publication of the student paper *Tharunka.*
7. A free legal service run by a qualified lawyer employed by the Students' Union Council.
8. Students' Union Record Shop which sells discount records and tapes.
9. The Nuthouse which deals in bulk and health foods.

10. Secondhand Bookshop for cheap texts.
11. Clubs and societies which receive money from the Students' Union through CASOC (Clubs and Societies on Campus).
12. The sale of electronic calculators and accessories at discount rates.
13. Provision of a bail fund.

The Students' Union is located on the second floor, Stage 3, the Union.

Chaplaincy Centre

This service is provided for the benefit of students and staff of various religious and spiritual beliefs. Chaplains are in attendance at the University at regular times. A Chapel is also available for use by all denominations. For further details, turn to page 2.

Other Services and Activities

CASOC All clubs and societies on campus (except sporting clubs) are loosely organized under the umbrella of CASOC, which is a committee of the Students' Union. Some of these clubs are: the Motor Cycle Club; Chess Club; Dramsoc; Opunka; Kite Club and the Jazz Society.

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

University Co-operative Bookshop Limited Membership is open to all students, on initial payment of a fee of $10, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

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.

Australian Armed Forces Enquiries should be directed to:

Royal Australian Navy Royal Australian Navy Liaison Officer, Emeritus Professor J.S. Ratcliffe, Commander, RANR (Rtd), International House. Phone extension 3093 or 663 0473.

University of New South Wales Regiment The Adjutant, Regimental Depot, Day Avenue (just west of Anzac Parade). Phone 663 1212.

Royal Australian Air Force Undergraduates interested in the RAAF Undergraduate Scheme should contact The Recruiting Officer, Defence Forces Recruiting Centre, 323 Castlereagh Street, Sydney. Phone 212 1011.

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 diploma courses
- Approved combined bachelor degree courses
- Master's qualifying courses (one year)

Benefits

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

1979 Higher School Certificate candidates and tertiary students receiving an allowance are sent forms in January 1980. Other students may obtain forms from the Admissions Section *or* Student Employment and Scholarships Section, *or* from the Commonwealth Department of Education, 59 Goulburn Street, Sydney, NSW 2000 (phone 218 8800).

Continuing students should submit applications as soon as examination results are available. New students should do so as soon as they are enrolled. All students should apply by 31 March 1980, otherwise benefits will not be paid for the earlier months of the year.

Scholarships, Cadetships, Prizes

1. *Undergraduate Scholarships* In addition to finance provided under the Commonwealth Government's Tertiary Education Assistance Scheme there are a number of scholarships, cadetships, prizes and other forms of assistance available to undergraduate students. Details of procedures for application for these awards are contained in the Calendar.

There are also special scholarships not administered by the University, information about which may be obtained from the appropriate School office.

Further information and advice regarding scholarships is available from the Student Employment and Scholarships Section in the Chancellery.

2. *Graduate Awards* An honors degree is generally an essential requirement for gaining one of the many graduate

scholarships which are available at the University. Therefore gifted students should not neglect the opportunity to qualify for honours and thus become eligible for an award.

Details of graduate awards are contained in the Calendar.

Other Financial Assistance

In addition to the Tertiary Education Assistance Scheme financed by the Commonwealth 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 the Students' Union, the University Union and other sources have made funds available for urgent cash loans not exceeding $100. These loans are normally repayable within one month.

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

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

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

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

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

Financial Assistance to Aboriginal Students

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

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

Fund for Physically Handicapped and Disabled Students

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

Rules and Procedures

The University, in common with other large organizations, has some agreed ways of doing things in order to operate for the benefit of all members. The rules and procedures listed below will affect you at some time or another. In some cases there are penalties (eg fines or exclusion from examinations) for failure to observe these procedures and therefore they should be read with care.

Admission

Where can I get information about admission?

The Admissions Office, located in the Chancellery on the upper campus, provides information for students on admission requirements, undergraduate and graduate courses and enrolment procedures. The Admissions Office is open from 9 am to 5 pm Monday to Friday (excluding the lunch hour 1 pm to 2 pm). During enrolment the office is also open for some part of the evening.

The Office provides information about special admission (including mature age entry), admission with advanced standing and admission on overseas qualifications. The Office also receives applications from students who wish to transfer from one course to another, resume their studies after an absence of twelve months or more, or seek any concession in relation to a course in which they are enrolled. It is essential that the closing dates for lodgment of applications are adhered to. For further details see the sections below on **Enrolment** and **Fees**.

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on **Admission Requirements** in the Calendar), from

students seeking admission with advanced standing, or from students who have a record of failure at another university, are referred by the Admissions Office to the Admissions Committee of the Professorial Board.

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

Details of the procedure to be followed by students seeking entry to first year undergraduate degree courses at the University may be obtained from the Admissions Office or the Universities and Colleges Admissions Centre.

How do I qualify admission?

In order to enter an undergraduate course you must qualify for matriculation to the University, and be selected for admission to the Faculty or course you wish to enter. Full details of matriculation and admission requirements are contained in the Calendar and in a pamphlet obtainable at the Admissions Office.

Enrolment

How do I enrol?

All students, except those enrolling as graduate research students (see below), must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form or on the day their General Studies electives are approved if the course requires this.

All students, except those enroling as graduate research students and those exempted (see below), should on that day also *either* pay the required fees *or* lodge an enrolment voucher or other appropriate authority.

For details of the locations and hours for enrolment see *Enrolment Procedures 1980*, a free booklet obtainable from the Admissions Office or from your School or Faculty Office.

What happens if I am unable to pay fees at the time of enrolment?

If you are unable to pay fees by the due date you may apply to the Deputy Registrar (Student Services) for an extension of time, which may be granted in extenuating circumstances.

If a student is unable to pay the fees the enrolment form must still be lodged with the Cashier and the student will be issued with a 'nil' receipt. The student is then indebted to the University and must pay the fees by the end of the second week of the session for which enrolment is being effected. Penalties apply if fees are paid after that time (see **Fees** below) unless the student has permission from the Deputy Registrar (Student Services). 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.

New Undergraduate Enrolments

Persons who are applying for entry in 1980 must lodge an application for selection with the Universities and Colleges Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1979.

Those who are selected will be required to complete enrolment at a specified time before the start of Session 1. Compulsory fees should be paid on the day. In special circumstances, however, and provided class places are still available, students may be allowed to complete enrolment after the prescribed time.

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

Re-enrolment

Students who are continuing courses (or returning after approved leave of absence) should enrol through the appropriate School in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Admissions Office 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, PO Box 7049, GPO, Sydney 2001, by 1 October 1979.

Restrictions Upon Re-enrolling

Students enrolled for the first time in any undergraduate course in the University who failed more than half their program in 1979; students who have failed more than once a subject prescribed as part of their course; and students required by the Re-enrolment Committee to show cause should not attempt to re-enrol but should follow the written instructions they will receive from the Registrar.

For the purpose of calculating a student's program, all subjects taken during the year, including repeat subjects, are counted.

Miscellaneous Enrolments

Students may be permitted to enrol as miscellaneous students in subjects not counted as part of (ie a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. Students who are under exclusion may not be enrolled as miscellaneous students in subjects which may be counted towards courses from which they have been excluded.

Students seeking to enrol as miscellaneous students should obtain a letter of approval from the Head of the appropriate

School or his representative permitting them to enrol in the subject concerned. The letter should be given to the enrolling officer at the time of enrolment.

Final Dates for Completion of Enrolments

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 (14 March 1980) 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 (28 March 1980) except with the express approval of the Deputy Registrar (Student Services) and the Heads of Schools concerned. No enrolments for courses in Session 2 only will be accepted after the end of the second week of Session 2 (1 August 1980) except with the express approval of the Deputy Registrar (Student Services) and the Heads of Schools concerned.

How do assisted students (eg scholarship holders) enrol?

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

What special rules apply if I wish to be considered for admission with advanced standing?

If you make application to register as a candidate for any degree or other award granted by the University you may be admitted to the course of study with such standing on the basis of previous attainments as may be determined by the Professorial Board. For complete details regarding 'Admission with Advanced Standing' consult the Calendar.

Can I transfer from one course to another?

To transfer from one course to another you must apply on an application form obtainable from the Admissions Office by Friday 11 January 1980. If your application is successful you are required to comply with the enrolment procedures for the year/stage of the new course and, unless otherwise instructed, you should present the letter granting transfer to the enrolling officer. If you intend to transfer, you should also inform the enrolling officer of the School in which you were enrolled in 1979.

Can I change my course program?

If you wish to seek approval to substitute one subject for another, or add one or more subjects to your program or discontinue part or all of your program, you must make application to the Registrar through the office controlling your course, from which application forms are available. The Registrar will inform you of the decision. Application to enrol in additional subjects must be submitted by 28 March 1980 for Session 1 only and Whole Year subjects and by 15 August 1980 for Session 2 only subjects.

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

Withdrawal from courses and subjects

Courses

1. Students withdrawing from courses (see also **Subjects**, below) are required to notify the Registrar in writing. In some cases students will be entitled to fee refunds.

For details see the Calendar.

Subjects

2. 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 subject concerned, except in exceptional circumstances.

(1) for one session subjects, the end of the seventh week of that session (18 April or 5 September)

(2) for whole year subjects the end of the second week of Session 2 (1 August)

How do I enrol after an absence of twelve months or more?

If you have had an approved leave of absence for twelve months or more and wish to resume your course you should follow the instructions about re-enrolling given in the letter granting your leave of absence. If you do not fully understand or have lost these instructions, then you should contact the Admissions Office before November in the year preceding the one in which you wish to resume your course.

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

Are there any restrictions upon students re-enrolling?

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

First-year Rule

1. A student enrolled in the first year of any undergraduate course of study in the University as set out in the relevant faculty handbook shall be required to show cause why he/she should be allowed to continue the course if he/she fails more than half the program in which he/she is enrolled. In order that students may calculate half their program, the weighting of subjects in each course is defined in *Schedule A**, which may be varied from time to time by the Professorial Board.

Repeated-failure Rule

2. A student shall be required to show cause why he/she should be allowed to repeat a subject which that student has failed more than once. *Where the subject is prescribed as part of the student's course he/she shall also be required to show cause why he/she should be allowed to continue that course.*

General Rule

3. A student shall be required to show cause if, in the opinion of the faculty or board of studies, his/her academic record is such as to demonstrate the student's lack of fitness to pursue a subject or subjects and/or course or courses.

The Session-unit System

4. (1) A student who infringes the provision of Rules **1.** or **2.** at the end of Session 1 of any year will not be required to *show cause* at that time but 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 that course.

(2) Such a student will be required to *show cause* at the end of the year, except that a student who has infringed Rule **2.** at the end of Session 1, repeats the subject(s) in question in Session 2, and passes it/them, will not be required to *show cause* on account of any such subject.

Exemption from Rules by Faculties

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

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

'Showing Cause'

6. (1) A student wishing to *show cause* must apply for special permission to re-enrol. Application should be made on the form available from the Examinations and Student Records Section 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 Re-enrolment Committee which shall determine whether the cause shown is adequate to justify the granting of permission to re-enrol.

Appeal

7. (1) Any student who is excluded by the Re-enrolment Committee from a course and/or subject(s) under the provisions of the Rules may appeal to an Appeal Committee constituted by Council for this purpose with the following membership:

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

The Chairman of the Professorial Board, of if he 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.

(2) The notification to any student of a decision by the Re-enrolment Committee to exclude him/her from re-enrolling in a course and/or subject(s) shall indicate that the student may appeal against that decision to the Appeal Committee. In lodging such an appeal with the Registrar the student should provide a complete statement of all grounds on which the appeal is based.

*For details of Schedule A see **Restrictions upon Re-enrolling** in the Calendar.

(3) The Appeal Committee shall determine the appeal after consideration of the student's academic record, his/her application for special permission to re-enrol, and the stated grounds of appeal. In exceptional circumstances, the Appeal Committee may require the student to appear in person.

Exclusion

8. (1) A student who is required to *show cause* under the provisions of Rules **1.** or **3.** and either does not attempt to *show cause* or does not receive special permission to re-enrol from the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the subject(s) and course(s) on acount of which he was required to *show cause*. Where the subjects failed are prescribed as part of any other course (or courses) he/she shall not be allowed to enrol in any such course.

(2) A student who is required to *show cause* under the provisions of Rule **2.** and either does not attempt to *show cause* or does not receive special permission to re-enrol from the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in any subject he/she has failed twice. *Where the subject failed is prescribed as part of the student's course he/she shall also be excluded from that course.* Where the subject failed is prescribed as part of any other course (or courses) he/she shall not be allowed to enrol in any such course(s).

(3) A student excluded from a course or courses under the provisions of Rule **1.** or **2.** may not enrol as a miscellaneous student in subjects which may be counted towards any such course.

Re-admission after Exclusion

9. (1) An excluded student 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 which re-admission is sought. Such applications will be considered by the Admissions Committee of the relevant Faculty or Board.

(b) An application for re-admission to a subject should be made to the Registrar before 30 November in the year prior to which re-admission is sought. Such applications will be considered by the relevant Head of School.

(3) An application 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 an applicant's capacity to resume studies at the University.

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

10. If students fail a subject at the examinations in any year or session and re-enrol in the same course in the following year or session they must include in their program 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.

How do I apply for admission to degree or diploma?

If your current program will enable you to complete all requirements for a degree or diploma, including industrial training where necessary, you should complete the form *Application for Admission to a Degree* by the dates shown in the **Calendar of Dates** (see page 2) and on the *Notification of Examination Results*. The forms are available from the Enquiry Counter in the north wing of the Chancellery and will be mailed to all potential graduates.

The completion and submission of the form ensures that:

1. The correct spelling and sequence of names is recorded on the degree certificate. **2.** Any previous academic qualifications are shown in the graduation ceremony program. **3.** All correspondence relating to the ceremony is forwarded to the correct address. ***Note:*** If notifying change of address after the form has been submitted an additional form *Final Year Students' Graduation: Change of Address* should be submitted.

If you meet all the requirements, the degree or diploma will be conferred without the necessity for further action by you. Students should advise the Registrar, in writing, if they do not wish to have the degree or diploma conferred for any reason, including the decision to proceed to an honours degree. To ensure that the degree is not conferred advice should reach the Registrar no later than 24 July 1980 for students completing at the end of Session 1, and 1 March 1981 for those completing at the end of Session 2.

Fees

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

Do I have to pay for tuition?

No tuition fees are charged.

What other fees and charges are payable?

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

How much is my contribution to student activities and services on campus?

All students (with the exceptions noted below) will be required to pay the following fees if enrolling for a program involving two sessions. Those enrolling for only one session will pay one-half of the Student Activities Fees, and the full University Union entrance fee, if applicable.

University Union Entrance Fee

Payable on first enrolment	$25

Student Activities Fees

University Union, annual subscription	$55
Sports Association, annual subscription	$11
Students' Union	
Students enrolling in full-time courses, annual subscription	$17
Students enrolling in part-time courses and miscellaneous subjects, annual subscription	$13
Miscellaneous annual fee	$25

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

Are fees charged for examinations?

Generally, there are no charges associated with examinations; however two special examination fees are applied:

Examinations conducted under special circumstances—for each subject	$11
Review of examination result—for each subject	$11

What penalties exist for late payment of fees?

The following additional charges will be made in 1980 when fees are paid late:

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.

Locations and Hours of Cashier

Cashier's Offices are open during the enrolment periods. Details of locations and hours are listed in *Enrolment Procedures 1980*, a free booklet obtainable from your School or Faculty Office or from the Admissions Office.

Who is exempt from payment of fees?

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

2. Students enrolled in courses classified as *External* are exempt from all Student Activities Fees and the University Union entrance fee.

3. Students enrolled in courses at the W.S. and L.B. Robinson University College and in the faculty of Military Studies are exempt from the fees mentioned 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 in a miscellaneous subject or subjects to be credited towards the degrees or diplomas for which they are enrolled elsewhere are exempt from all Student Activities Fees and the University Union entrance fee.

6. Undergraduate students of a recognized university outside Australia who attend the University of New South 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 graduate students who are given formal permission to pursue their studies at another institution for one or more sessions.

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

Is exemption from membership possible?

The Registrar is empowered to grant exemption from membership 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.

How much will textbooks and special equipment (if any) cost?

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

Will I receive any refund if I withdraw from a course?

Yes. The following rules apply:

1. If you withdraw from courses you are required to notify the Registrar in writing.

2. Where notice of withdrawal from a course is received by the Registrar before the first day of Session 1 a refund of all fees paid will be made. After that time only a partial refund will be made. See the Calendar for details.

What happens if I fail to pay the prescribed fees or charges?

If you fail to pay prescribed fees or charges or become otherwise indebted to the University and you fail to make a satisfactory settlement of your indebtedness upon receipt of due notice then you cease to be entitled to the use of University facilities. You will not be permitted to register for a further session, to attend classes or examinations, or be granted any official credentials. In the case of a student enrolled for Session 1 only or for Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (25 April 1980). In the case of a student enrolled for Session 2 only, this disbarment applies if any portion of fees is outstanding after the end of the sixth week of Session 2 (29 August 1980).

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

Can I get an extension of time to pay?

If you apply before the due date and extenuating circumstances exist, an extension of time may be granted. Apply to the Deputy Registrar (Student Services).

Examinations

When are examinations held?

Examinations for Session 2 and for Whole Year subjects are held in November/December. Examinations for Session 1 subjects are held during the Midyear Recess. Provisional timetables indicating the dates and times of examinations and notices of the location of examinations are posted on the University notice boards on the campus, including the Western Grounds Area. Final timetables indicating the dates, times, locations and authorized aids are available for students two weeks before the end of each session. You must advise the Examinations Unit (the Chancellery) of any clash in examinations. Details of dates are published in the **Calendar of Dates** (see pages 2-4 for May/June and October/November).

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

In the assessment of your progress in courses, 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.

How are examination passes graded?

Passes are graded: High Distinction, Distinction, Credit and Pass. Satisfactory indicates the satisfactory completion of a subject for which graded passes are not available. A Pass Conceded may be granted to a student whose mark in a subject is slightly below the standard required for a pass but whose overall satisfactory performance warrants this concession.

A Pass Conceded in a subject will normally allow progression to another subject for which the former subject is a prerequisite. In a particular subject, however, a subject authority may specify that a pass conceded is insufficient to meet a particular subject prerequiste.

When are examination results available?

Final examination results will be posted to your term address (which can be altered up to 30 November) or to your vacation address (fill in a form obtainable at the Enquiry Desk, Chancellery, also by 30 November). Results are also posted on School noticeboards and in either the University library or the foyer of the Sir John Clancy Auditorium. No examination results are given by telephone.

Can examinations results be reviewed?

Examination results may be reviewed for a fee of $11 a subject, which is refundable in the event of an error being discovered. This review consists mainly of ensuring that all questions attempted have been marked and of checking the total of the marks awarded. Applications for review must be submitted on the appropriate form to the Examinations and Student Records Section together with the necessary fee not later than fifteen working days after the issue of the *Notification of Results* form.

A review of a result is not a detailed assessment of a student's standard of knowledge and understanding of, and skills in, the subject.

Are allowances made if students are sick before or during an examination?

A student who through serious illness or other cause outside his control *is unable to attend an examination* is required to bring the circumstances (supported by a medical certificate or other evidence) to the notice of the Registrar *not later than seven days after the date of the examination*, unless there are exceptional circumstances.

A student who believes that his performance in a subject has been affected by serious illness *during the year* or by other cause outside his control, and who desires these circumstances to be taken into consideration in determining his standing, is required to bring the circumstances (supported by a medical certificate or other evidence) to the notice of the Registrar as soon as the circumstances are known but *not later than seven days after the date of the examination*, unless there are exceptional circumstances.

A student who attempts an examination, yet claims that his performance is prejudiced by sickness *on the day of the examination* must notify the Registrar or Examination Supervisor *before, during, or immediately after the examination*, and may be required to submit to medical examination.

When submitting a request for consideration candidates are required to give details of their registration number, address, course, specialization, year or stage, full or part-time and subject number, title and date of the examination affected.

A student suffering from a physical disability which puts him at a disadvantage in written examinations should apply to the Assistant Registrar, Examinations and Student Records Section (Ground Floor, the Chancellery) immediately the disability is known. If necessary, special arrangements will be made to meet the student's requirements.

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.

Compulsory Industrial Training

Examinations including deferred 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 Unit, immediately the location of the industrial training is known. Special forms for this purpose are available at the Enquiry Desk, in the north wing of the Chancellery.

Arrival at Examinations

Examination rooms will be open to students 25 minutes before the commencement of the examination, Candidates are requested to be in their places at least 15 minutes before the commencement to hear announcements. The examination paper will be available for reading 10 minutes before commencement.

Use of Linguistic Dictionaries

All answers must be in English unless otherwise directed. Foreign students who have the written approval of the Assistant Registrar, Examinations and Student Records Section, may use standard linguistic dictionaries. Dictionaries should be presented for approval not later than 14 days before the commencement of the examination period.

How are examinations conducted?

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 15 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 30 minutes from the time of commencement of the examination.

5. Candidates shall not be permitted to leave the examination room before the expiry of 30 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 an 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.

Abolition of Deferred Examinations

The system of formal deferred examinations administered by the Registrar's Division was abolished from 1 March 1978. Schools and Faculties may carry out whatever additional assessment may be considered appropriate, including assessment or additional assessment on medical or compassionate grounds.

Can I buy copies of previous examination papers?

Yes—for 5¢ each from the University Union's Upper Campus Shop in the Commerce Building.

Essays

Should I list my sources?

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

Student Conduct on Campus

Is there a detailed code of rules related to the general conduct of students?

No. The University has not considered it necessary to formulate a detailed code of rules relating to the general conduct of students.

Now that you have become a member of the University you should understand that this involves an undertaking on your part to observe its rules, By-laws and other requirements, and to pay due regard to any instructions conveyed by any officer of the University.

What are the rules related to attendance at classes?

You are expected to be regular and punctual in attendance at all classes in the course or subject in which you are enrolled. All applications for exemption from attendance at lectures or practical classes must be made in writing to the Registrar.

In the case of illness or of absence for some other unavoidable cause you may be excused by the Registrar for non-attendance at classes for a period not more than one month or, on the recommendation of the Dean of the appropriate Faculty, for a longer period. Applications should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If assessment procedures have been missed, this should be stated in the application.

If you attend less than 80per cent of possible classes, you may be refused final assessment in that subject.

Why is my University and Union card important?

All students enrolled for courses leading to degrees and/or diplomas, except those exempt from fees, are issued with a University and Union membership card. Your card must be carried during attendence at the University and shown on request.

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

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

If you lose your card it is important to notify the University Union as soon as possible.

New students will be issued with cards on enrolment.

Why should I inform the University if I change my address?

If you change your address you should notify the Student Records Section of the Registrar's Division as soon as possible. Failure to do this could lead to important correspondence (including examination results) not reaching you. The University cannot accept responsibility if official communications fail to reach students who have not notified their change of address. *Change of Address Advice* forms are available at Faculty and School offices and at the Enquiry Desk in the north wing of the Chancellery.

All communications from the University, including examination results, will be sent to the session address. Change of address advice will be accepted up to 30 November, except for final-year students wishing to change their *Submissions of Details Associated with Graduation* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

Will the University release information to third parties without my permission?

In general, no. The University treats examination results 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 impractible 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, there are sometimes accusations made that the University has revealed information, including addresses (especially to insurance companies).

All students should be aware that students' addresses are eagerly sought by various commercial agents and that sometimes tricks are used to obtain them. For example, from time to time 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 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.

How are student records kept up to date?

Enrolment details forms will be sent to all students on 24 April and 12 September. It is not necessary to return these forms unless any information recorded thereon is incorrect. Amended forms must be returned to the Examinations and Student Records Section within fourteen days. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Amended forms returned to the Registrar will be acknowledged in writing within 14 days.

Is there any rule related to the ownership of students' work?

Yes. 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 you as part of your courses, or submitted for any award or competition conducted by the University.

Can I get a permit to park on campus?

Only 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.

Lost property?

All enquiries concerning lost property should be made to the Superintendent on extension 3580 or to the Lost Property Office at the Union.

Further Information

Where can I get further information concerning courses, admission requirements, scholarships and enrolment procedure?

General

Any student who requires information on the application of these rules or any service which the University offers, may make enquiries in the Chancellery and in case of difficulties should visit the office of the Deputy Registrar (Student Services).

Notices

Official University notices are displayed on the noticeboards and students are expected to be aquainted 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), Electrical Engineering Building, Main Building (Physics and Mining Engineering) and in the Western Grounds Area.

Notices are placed on the University noticeboards each month detailing forthcoming important dates. Any change to the Calendar of Dates is included in these notices.

Appeals

Section 5(c) of chapter III of the By-laws provides: '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'.

The Calendar

Please consult the Calendar if you want a more detailed account of the information contained in this section.

Vice-Chancellor's Official Welcome to New Students

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

Full-Time Students

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

Thursday 28 February 1980
11 am in the Clancy Auditorium

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

Friday 29 February 1980
11 am in the Clancy Auditorium

Part-time Students

Thursday 28 February 1980
6.30 pm in the Clancy Auditorium

Meeting for Parents of New Students

Friday 29 February 1980
7.30 pm in the Clancy Auditorium

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 problems associated with courses.

The Faculty of Engineering

The Faculty consists of six Schools: Civil Engineering, Electrical Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying, and Transport and Highways. In addition, the Centre for Biomedical Engineering is located in the Faculty.

School of Civil Engineering

The School of Civil Engineering consists of four departments, Water Engineering, Civil Engineering Materials, Structural Engineering, and Engineering Construction and Management. The School conducts both part-time and full-time undergraduate courses in Civil Engineering. In addition, all departments conduct graduate courses and carry out graduate research programs in many fields.

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. 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 and is the centre for instruction and research in hydraulics.

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

School of Electrical Engineering

The School of Electrical Engineering comprises five departments — Communications, Computer Science, Electric Power Engineering, Solid State Electronics, and Systems and Control Engineering.

Each department carries out research in its own field and offers lecture and laboratory courses at the undergraduate and graduate levels. Subjects of common interest are provided by the School as a whole.

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.

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, nominally over four years or on a part-time basis, nominally over six years, or on a combined full-time/part-time basis, subject to approval by the Head of School.

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 continues to offer the later stages of six year part-time courses leading to the award of the degree of Bachelor of Science (Engineering) in the same four fields as offered for the BE degree course, though no new enrolments into these courses are now accepted.

Formal graduate courses of study are available, with a wide choice of subjects, leading to the degree of Master of Engineering Science. There are special Master of Engineering Science degree courses in Refrigeration and Air Conditioning, and in Industrial Engineering. The Department of Industrial Engineering within the School offers a course leading to the award of a Graduate Diploma.

Graduates with a good first degree may register for the higher degrees of Master of Engineering and Doctor of Philosophy. Current research fields are as follows — Aerodynamics, Agricultural Engineering, Applied Plasticity, Automatic Control, Bio-mechanics, Dynamics, Gas Dynamics, Heat Transfer, Fluid Mechanics, Metal Cutting, Naval Hydrodynamics, Refrigeration and Air Conditioning, and Two-phase Flow.

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 in the University of New South Wales was established in 1961. The School presently 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.

The School is presently situated in the Electrical Engineering building at Kensington. Library, workshop, digital and analogue computing facilities are available. 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's Research Establishment at Lucas Heights can be made available for research purposes. Close personal contact is maintained between members of the School and the Engineering Research Division at Lucas Heights.

School of Surveying

The School of Surveying consists of three Departments: Geodesy; Photogrammetry, including land studies and cartography; and Surveying, including astronomy and computations. It 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. The part-time course is no longer available. The graduate courses offered are Master of Surveying Science, a two-year part-time or one-year full-time course; and the research degrees 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, a control minicomputer within the School's Image Data Analysis Centre, and several programmable desk calculators. A library of programs is maintained for use with the different computers.

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

School of Transport and Highways

The School of Transport and Highways is situated on the Randwick Sub-Campus and offers graduate courses leading to the award of the MEngSc degree and graduate diplomas in Highway Engineering and Transport. It also conducts, each year, practice-oriented special courses in Traffic Planning and Control, and Highway Engineering. The School supervises research degrees in a wide range of topics including urban and regional land use/transport planning, local area transport planning, transport systems design and operation, highway planning, maintenance and operations, and the environmental impact of transport on the community, eg noise, amenity, accidents and pollution.

Centre for Biomedical Engineering

The Centre was established in 1976 as an interdisciplinary unit to promote and coordinate biomedical engineering studies and research being conducted by various departments within the University and its associated 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, in association with other schools, the degree of Doctor of Philosophy. The Master's degree is obtained primarily through course work but includes a research project which is supervised 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 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.

Faculty of Applied Science

Courses in Chemical Engineering, Ceramic Engineering, Metallurgy, Metallurgical Process Engineering, Mining Engineering and Textile Engineering are taught 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. Central to this discussion are the basic objectives which are implicit in the various engineering courses. These are to impart to and foster within its students the following:

- Technical and scientific and creative skills required to solve all aspects of engineering problems. **Skills**
- An understanding of human interaction with the environment, so that the impact of engineering activity can be assessed.
- The ability to direct and manage engineering activities. **Communication**
- The ability to communicate, with other members of the profession, with industrial personnel, administrators, and with members of the public.
- The desire and ability for continuing self-education and reappraisal of current practice, including the ability to innovate new ideas and practices. **Creativity**
- 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 executive committee and faculty. 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.

H. R. Vallentine
Dean
Faculty of Engineering

N. L. Svensson
Chairman
Faculty of Engineering

Faculty Information

Who to Contact

If you require advice about enrolment, degree requirements, progression within courses, or any other general faculty matters, contact:

Ms Margaret Leonard, Administrative Assistant, Faculty of Engineering, Room 508A, Surveying and Geography Building

For information about 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: Associate Professor C. A. Stapleton, Room G6, *or* Ms R. C. Horwood, School Office, School of Electrical Engineering

School of Mechanical & Industrial Engineering: Associate Professor J. Y. Harrison, Room 112, *or* Mr G. Dusan, Room 107, School of Mechanical & Industrial Engineering

School of Nuclear Engineering: Professor J. J. Thompson, Room 324AB, Electrical Engineering Building

School of Surveying: Mr J. V. Fonseka, School Office, Room 529, Geography & Surveying Building

School of Transport & Highways: Professor W. R. Blunden, King Street, Randwick

Centre for Biomedical Engineering: Associate Professor P. C. Farrell, Room 420, Geography & 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 1980 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1980* 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 serves the information needs of senior undergraduate students, graduate students and members of the

academic staff. It contains books, a large collection of journals, and guides to the literature including abstracting and indexing journals in the subject areas of pure and applied science, technology, engineering and architecture. The library also houses a growing map collection and some microform material. All material in the library bears the prefix 'P' and is indexed in the library's central catalogue on Level 2. There is also a catalogue in the Physical Sciences Library. There is seating for approximately 300 people, and a number of room carrels and seminar rooms are available for use. Photocopying facilities are provided. Journals may not be borrowed from the collection. The library staff on Level 7 are ready to assist readers with any 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 scoieties serve the interests of students in the various courses in the Faculty of Engineering: Biomedical Engineering Society (BioEng Soc); Electrical Engineering Society (ELSOC); Civil Engineering Student Society (CIVSOC); Naval Architecture Student Association (NASA); Surveying Society (SURVSOC); Computing Science Association (CSA); Undergraduate Society of Mechanical & Industrial Engineers (USMIE).

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 School of Transport and Highways and the Structures Laboratory of the School of Civil Engineering occupy new 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.

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 object 'to promote the science and practice of engineering in all its branches'.

The Institution functions through a series of divisions, our 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, *The Australian Surveyor* and *The NSW Surveyors' Monthly Bulletin* 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 recognises 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 six Schools — Civil Engineering, Electrical Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, Transport and Highways, and Surveying. The Schools of Civil Engineering, Electrical Engineering, and Mechanical and Industrial Engineering offer full-time courses leading to the degree of Bachelor of Engineering, and part-time courses leading to the degree of Bachelor of Engineering or Bachelor of Science (Engineering). The School of Surveying offers a full-time course, which may also be taken in a sandwich form, leading to the degree of Bachelor of Surveying. The Schools of Nuclear Engineering and Transport and Highways, and the Centre for Biomedical Engineering 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 Courses

Full-time courses of four-years' duration are offered in Civil, Electrical, Mechanical, Industrial, and Aeronautical Engineering, and in Naval Architecture: all of these lead to the degree of Bachelor of Engineering. A four-year full-time course in Surveying is offered by the School of Surveying leading to the degree of Bachelor of Surveying. The award of the degree of Bachelor of Engineering is recognized by the Institution of Engineers, Australia, as giving complete exemption from the examinations required for admission to the grade of Member. 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.

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 Courses

Courses leading to the award of the degrees of Bachelor of Engineering in Civil, 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 courses leading to the award of the degree of Bachelor of Science (Engineering) in these five fields may be taken over a period of six years, but these courses are being phased out and new enrolments in them are no longer accepted. Enrolments are being accepted in the six-year part-time BSc(Eng) course in Electrical Engineering.

The award of the degree of BSc(Eng) is recognized at present by the Institution of Engineers, Australia, as giving complete exemption from the examinations required for admission to the grade of Member. However, recognition after 1980 is currently being reviewed by the Institution.

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.

A student 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 he does not take out the BSc(Eng) degree. Further, provided he continues as a registered student on transfer from one course to the other, he may retain any concession granted in the BSc(Eng) degree course.

Holders of the BSc(Eng) award 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 BSc(Eng) award 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.

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 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 recorded.

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.

Conditions for the Award of the Degree of Bachelor of Engineering

1. A candidate for 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

Conditions for the Award of the Degree of Bachelor of Surveying

1. A candidate for the degree of Bachelor of Surveying 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 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

Undergraduate Study

Course Outlines

School of Civil Engineering

Head of School
Professor I. K. Lee

Senior Administrative Officer
Mr R. W. Prior

The School of Civil Engineering offers a course leading to the degree of Bachelor of Engineering (BE), at pass or honours level, which can be taken on a 4-year full-time basis, a 7-stage part-time basis or any approved combination of full-time and part-time study.

A five years' full-time course leading to the award of the degrees of Bachelor of Science and Bachelor of Engineering (BSc BE) is offered.

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

Year 1

		Hours per week S1	S2
1.981	Physics (CE)*	5	3
2.981	Chemistry ICE**	6	2
5.0102	Introduction to Engineering Design	2	0
5.0201	Engineering Dynamics	0	4
5.0301	Engineering Drawing	0	3
8.170	Statics	4	0
8.171	Mechanics of Solids	0	2
8.271	Introduction to Materials	0	2
8.670	Introduction to Engineering Construction	0	1
10.001	Mathematics I***	6	6
		23	23

*Students are advised to attempt 1.981 Physics ICE but if timetabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt 1.001 Physics I or 1.011 Higher Physics I. On successful completion of one of these latter subjects students will be exempted from one technical elective.

**Students who have not satisfied the science prerequisite for 2.981 Chemistry ICE (ie 2 unit Science including Physics or Chemistry or 4 unit Science (multistrand) in the percentile range 31-100) are advised to apply to enrol in two acceptable alternative subjects, 2.111 Introductory Chemistry and 2.121 Chemistry 1A which together are equivalent to 2.981.

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

Year 2

		Hours per week S1	S2
8.172	Mechanics of Solids II	4	0
8.181	Structural Design I	2½	2½
8.272	Civil Engineering Materials I	4	4
8.301	Systems Engineering	2	2
8.571	Hydraulics I	0	3
8.671	Engineering Construction	3	0
10.022	Engineering Mathematics II	4	4
29.441	Surveying for Engineers	0	6
29.491	Survey Camp†	1½	1½
	Two Electives***	3	3
		24	26

***See Electives on following page.
†Students are required to attend a one-week Survey Camp, which is equivalent to 1½ class contact hours per week in each session.

Year 3

8.173	Structural Analysis I	3	0
8.174	Structural Analysis II	0	3
8.182	Structural Design II	3	3
8.273	Civil Engineering Materials II	3	3
8.351	Engineering Mathematics	5	0
8.572	Hydraulics II	3	0
8.573	Hydraulics III	0	3
8.581	Water Resources I	3	0
8.582	Water Resources II	0	3
8.672	Planning and Management I	0	4
	Two Electives***	3	3
		23	22

***See Electives on following page.

Year 4

8.001	Industrial Training	0	0
8.191	Structural Engineering	3	0
8.274	Civil Engineering Materials III	3	3
8.583	Water Resources III	3	0
8.673	Planning and Management II	3	0
8.674	Planning and Management III	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
	Six Electives***	9	9
		21	20

***See Electives on following page.

3620
Civil Engineering Part-time Course

Bachelor of Engineering
BE

Stage 1

		Hours per week S1	S2
1.001	Physics I*	6	6
10.001	Mathematics I*	6	6
		12	12

*Students attending in the daytime may attempt alternative subjects. See the footnote following Year 1 Full-time.

Stage 2

2.981	Chemistry ICE**	6	2
5.0102	Introduction to Engineering Design	0	2
5.0201	Engineering Dynamics	0	4
5.0301	Engineering Drawing	0	3
8.170	Statics	4	0
8.171	Mechanics of Solids	0	2
8.271	Introduction to Materials	2	0
8.670	Introduction to Engineering Construction	1	0
		13	13

**See this footnote below Year 1 (previous page).

Stage 3

8.172	Mechanics of Solids II	0	4
8.272	Civil Engineering Materials I	4	4
10.022	Engineering Mathematics II	4	4
29.441	Surveying for Engineers*	6	0
29.491	Survey Camp†	1½	1½
		15½	13½

*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 1½ class contact hours per week in each session.

Stage 4

8.181	Structural Design I	2½	2½
8.273	Civil Engineering Materials II	3	3
8.301	Systems Engineering	2	2
8.571	Hydraulics I	3	0
8.671	Engineering Construction	0	3
	Two Electives***†	3	3
		13½	13½

***See Electives on following page.
†One elective for 1978 Stage 1 students, if they have completed an elective.

Stage 5

		Hpw S1	S2
8.173	Structural Analysis I	0	3
8.182	Structural Design II	3	3
8.351	Engineering Mathematics	0	5
8.572	Hydraulics II	0	3
8.672	Planning & Management I	4	0
	Two Electives***	6	0
		13	14

***See Electives below.

Stage 6

8.174	Structural Analysis II	3	0
8.191	Structural Engineering	0	3
8.274	Civil Engineering Materials III	3	3
8.573	Hydraulics III	3	0
8.581	Water Resources I	0	3
8.582	Water Resources II	3	0
	Two Electives***	1½	4½
		13½	13½

***See Electives below.

Stage 7

8.001	Industrial Training	0	0
8.051	Design Project—Materials	0	1¼
8.052	Design Project—Structures	0	1¼
8.053	Design Project—Water	1¼	0
8.054	Design Project—Construction	1¼	0
8.583	Water Resources III	0	3
8.673	Planning & Management II	0	3
8.674	Planning & Management III	3	0
	Four Electives***	6	6
		11½	14½

***See Electives below.

Electives

Of ten required electives for the BE degree course at least four are in General Studies and at least four are technical electives. Two of the General Studies electives are taken prior to Year 4 or Stage 6.

Approved technical electives for Year 2 are 6.851 Electronics and Instrumentation, 6.832 Industrial Electrical Machinery, 8.039 Computer Programming, 8.040 Advanced Engineering Geology, 36.411 Town Planning, 8.047 History of Civil Engineering.

Approved technical electives for Year 3 include those listed for Year 2 and 8.015 Road Engineering, 8.018 Construction Engineering, 8.021 Environmental Aspects of Civil Engineering, 8.023 Hydrodynamics, 8.027 New Materials I, 8.029 Continuum Mechanics, 8.041 Geological Engineering, 15.501 Introduction to Industrial Relations.

Approved technical electives for Year 4 include those listed for Year 2 and Year 3 and 8.011 Projects, 8.012 Elements of Architecture, 8.013 Bridge Engineering, 8.014 Computer Applications in Civil Engineering, 8.016 Hydraulics, 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 II, 8.030 Construction Management, 8.031 Construction Project Finance, 8.032 Law for Builders, 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.

Double Degree

3730
Double Degree of BSc BE in Civil Engineering

Students may seek permission to undertake a five years' full-time course leading to the award of a *double degree* of Bachelor of Science and Bachelor of Engineering (BSc BE). The course is administered by the Faculty of Engineering.

Normally, students enrolled in the BSc BE 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 course consists of the Civil Engineering program (3620), with six instead of ten 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.

Physical Metallurgy and Chemistry

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271 8.670
10.001***

Year 2
2.002A, 2.042C
4.402, 4.502
8.172, 8.181, 8.272
10.022
1 elective†

Year 3
4.403, 4.703
8.173, 8.174, 8.182, 8.351, 8.571
29.441, 29.491
2 electives†

Year 4
2.003A, 2.003C, 2.013C
4.503
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†

Year 5
2 electives†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.274, 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 degree course.
* ** *** †See footnotes below.

Geography and Environmental Chemistry

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.670
10.001***

Year 2
2.002A, 2.002D, 2.042C
8.172, 8.181, 8.272
10.022
27.801, 27.802

Year 3
2.043A
8.173, 8.174, 8.182, 8.351, 8.571
27.811, 27.813
29.441, 29.491
2 electives†

Year 4
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
27.103
2 electives†
Choose 2 from:
27.203, 27.413, 27.423, 27.862, 27.863

Year 5
2 electives†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.274, 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 degree course.
* ** *** † See footnotes below.

Physics with Mathematics

Year 1
1.001 *or* 1.011
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.670
10.001***

Year 2
1.012
1.022, 1.032
8.172, 8.181, 8.272
10.1113 or 10.1213,
10.1114 or 10.1214,
10.2111 or 10.2211,
10.2112 or 10.2212
2 electives†

Year 3
1.023, 1.043, 1.053, 1.323
8.173, 8.174, 8.182, 8.351, 8.571
10.111A or 10.121A
29.441, 29.491
1 elective†

Year 4
1.033
1.133
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 2 Level II or Level III Mathematics units from Table 1 in the Sciences Handbook.

Year 5
8.001, 8.191, 8.274, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
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.

Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.670
10.001***

Year 2
8.172, 8.181, 8.272
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 elective†
Choose either **1.** *or* **2.***:*
1. *10.311A or 10.321A,*
10.311B or 10.321B
2. *Choose 3 units from:*
10.411B or 10.421B,
10.411A or 10.421A,
10.331,
10.2113 (or 10.2213) and 10.2114 (or 10.2214),
10.1111,
10.1112 or 10.121C

Year 3
8.173, 8.174, 8.182, 8.351, 8.571
29.441, 29.491
2 electives†
Choose 4 units from Mathematics from Table 1 of the Sciences Handbook (at least one must be Level III).

Year 4
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 3 Level III (not Level II/III) Mathematics units from Table 1 of the Sciences Handbook.

Year 5
8.001, 8.191, 8.274, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
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 degree course.
* ** *** † See footnotes below.

Geology with some Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.670
10.001***

Year 2
8.172, 8.181, 8.272
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
3 electives†

Year 3
2.042C
8.173, 8.174, 8.182, 8.351, 8.571
25.211, 25.221, 25.212
29.441, 29.491
1 elective†

Year 4
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
Choose four subjects from the following:
25.311, 25.312, 25.314, 25.321, 25.313, 25.324, 25.325, 25.326‡

Year 5
8.001, 8.191, 8.274, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
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 enrolling in Level III subjects in 1980 should refer to the 1979 Sciences Handbook for subject descriptions.
* ** *** † See footnotes below.

Computing with some Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.670
10.001***

Year 2
6.620, 6.631, 6.641
8.172, 8.181, 8.272
10.111A or 10.121A,
10.1113 or 10.1213,
10.1114 or 10.1214
2 electives†

Year 3
6.642, 6.643
8.173, 8.174, 8.182, 8.351, 8.571
10.2111 or 10.2211,
10.2112 or 10.2212
29.441, 29.491
1 elective†

Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 4
6.646, 6.647, 6.649
8.273, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 5
8.001, 8.191, 8.274, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
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 I or 1.011 Higher Physics I. On successful completion of one of these latter subjects students will be exempted from one technical elective.

**Students who have not satisfied the science prerequisite for 2.981 Chemistry 1CE (ie 2 unit Science including Physics or Chemistry or 4 unit Science (multistrand) in the percentile range 31-100) are advised to apply to enrol in two acceptable alternative subjects, 2.111 Introductory Chemistry and 2.121 Chemistry 1A.

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

†Of the six electives, four must be in General Studies and two must be technical electives. The technical electives are listed after Stage 7 of Course 3620. The choice of the technical electives must be approved by the Head of the School of Civil Engineering.

School of Electrical Engineering

Head of School
Professor M. W. Allen

Executive Assistant to Head of School
Associate Professor C. A. Stapleton

Senior Administrative Officer
H. G. Phillips

Adminstrative Assistant
Ms Robyn Horwood

Electrical Engineering has close links with the pure sciences and mathematics. Its technology is changing rapidy, 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 electrial engineering: there are Departments of Communications, Computer Science, Electric Power, Solid State Electronics, and Systems and Control Engineering. A number of inter-departmental and specialized groups (such as Digital Systems, Acoustics, Biomedical Engineering, Measurements etc.) are also active.

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.

The School of Electrical Engineering offers a full-time course of four years duration leading to the degree of Bachelor of Engineering (pass or honours), and a six year part-time course for the degree of Bachelor of Science (Engineering): provided prerequisites are met and the program can be timetabled, a student in either course may, with the approval of the Head of the School, complete the requirements by a combination of full-time and part-time study. Each subject of the BSc(Eng) course is generally identical with a subject of the BE program and the requirements of these subjects can be completed by either day or evening study in most cases: a part-time student is expected to be able to attend classes on at least one afternoon a week.

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 giving complete exemption from the examinations required for admission to Graduate or 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.

Industrial Experience

All students in the BSc(Eng) degree course must complete three years of concurrent appropriate industrial training. Students should enrol in the subject 6.902 Industrial Experience in the year in which they expect to graduate.

All students in the BE course must complete at least 60 days industrial experience usually in the summer recesses at the end of Years 2 and 3. Details of the BE requirements are available in the Industrial Training booklet produced by the Student Employment Service and Scholarships Unit:

3640
Electrical Engineering

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.961	Physics I*	6	6
2.121	Chemistry	6	0
5.030	Engineering C	6	0
6.010	Electrical Engineering I	0	6
10.001	Mathematics I*	6	6
	Either		
2.131	Chemistry		
	or	0	6
5.010	Engineering A		
	One General Studies Elective	1½	1½
		25½	25½

*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	4	0
10.111A	Pure Mathematics II (Linear Algebra)*	2	2
10.1113	Pure Mathematics II — Multivariable Calculus*	2½	0
10.1114	Pure Mathematics II — Complex Analysis*	0	2½

		Hpw S1	S2
10.2111	Applied Mathematics II — Vector Calculus*	2½	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations*	0	2½
	One General Studies Elective	3	0
Electrical Engineering II			
6.021A	Circuit Theory I	4	0
6.021B	Power	0	4
6.021C	Electronics I	0	4
6.021D	Introduction to Computing	0	4
6.021E	Digital Logic and Systems	4	0
		22	23

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

Year 3*

10.033	E. E. Mathematics III	2	2
10.361	Statistics SE	2	2
	One General Studies Elective	3	0
	Two Technical Electives†	4	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
		23	24

†Technical Electives available in 1980

1.992	Thermal Physics and Mechanics	4	0
6.613	Computer Organization and Design	5	0
8.113	Civil Engineering	4	0
6.056	Mechanical Engineering	0	4
6.641	Programming I	0	5
3.302	Fuels and Energy	0	4

A free choice may not be possible. Only one of 6.613 and 6.641 may be taken as a technical elective. Students wishing to do both computing subjects should contact the School.

*Students who intend to major in particular disciplines should note that certain subjects are prerequisites for the professional electives they choose in Year 4. Thus, 6.641 is a prerequisite for some of the professional computing electives.

Year 4

		Hpw	
6.911	Thesis*	2	21
	General Studies Elective	3	0
Electrical Engineering IV			
	6 Electives†	20	10
		25	31

*6.911 Thesis is done in the last two sessions of a student's course. In the first session, two hours per week, and in the second session, three days per week are devoted to directed laboratory and research work on an approved subject under the guidance of members of the lecturing staff. Generally, the project involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar and written thesis must be submitted on each project by the penultimate Monday in November or June.

†Electrical Engineering IV Electives

Four Electives are taken in Session 1 and two in Session 2. The program selected by each student must be approved by the Head of School. Not all electives are offered every session: students are advised each year which electives are available. 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 I
6.203 Power Engineering II
6.212 Power Engineering—Utilization
6.222 High Voltage and High Current Technology
6.303 High Frequency Circuits and Electronics I
6.313 High Frequency Circuits and Electronics II
6.322 Electronics IV
6.323 Communication Systems 2A
6.333 Communication Systems 2B
6.412 Systems and Control II
6.413 Modern Systems Engineering
6.432 Computer Control and Instrumentation
6.483 Biomedical Engineering
6.512 Advanced Semiconductor Device Theory
6.522 Transistor and Integrated Circuit Design
6.607A Computer Hardware Architecture
6.607B Advanced Software Technology
6.612 Computer Systems Engineering
6.622 Computer Application and Systems

*Students who have completed the prerequisites may request substitution of approved Science 3 Computing Science electives.

Prerequisites and Co-requisites

See Table next page.

Prerequisites and Co-requisites
Full-time Bachelor of Engineering Degree Course

Year	Subject	Prerequisites	Co-requisites
1	1.961 2.121	See Matriculation and Admission Requirements	
	2.131	2.121	
	5.010 5.030	See Matriculation and Admission Requirements	
	6.010	The Electricity & Magnetism section of 1.961	
	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 attempted	
	6.021C	1.982, 6.021A	
	6.021D	Computing strand of 5.030.	
	6.021E	10.001	
	10.111A	10.001	
	10.1113	10.001	
	10.1114	10.001	
	10.2111	10.001	
	10.2112	10.001	
	6.620	10.001	
	6.641	6.620 *or* 6.021D	
3	1.992	1.961, 10.001	10.2111, 10.2112
	6.056, 5.661	10.2111, 10.2112, 1.961	
	10.033	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	6.0312 attempted	
	6.0316	6.0313	6.021E, 6.0311
	6.0317	6.0311	10.361
4	6.041	6.0311, 6.0313	
	6.042	10.033, 10.361	
	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	6.0311, 6.0316, 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	6.412	
	6.432	6.021D, 6.021E, 6.0314, 6.0316	
	6.483	6.0311, 6.0313, 6.0314, 6.0316	
	6.512	6.0313	
	6.522	6.0313, 6.0316	
	6.607A 6.607B	6.602A, 6.602B, 6.602C, 6.602D** *or* 6.613, 6.632, 6.642, 6.643	
	6.612	6.021E, *or* 6.602A *or* 6.631	
	6.622	6.620 *or* 6.021D	
	6.911	(in graduating program only)	

*Two of 10.1113, 10.1114, 10.2111, or 10.2112 may be taken as co-requisites.
**At an acceptable level.
†One of 6.021B or 6.021C may be taken as a co-requisite.

3650
Electrical Engineering

Bachelor of Science (Engineering)
BSc(Eng)

Stage 1

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

Stage 2

2.121	Chemistry	6	0
5.030	Engineering C	0	6
6.010	Electrical Engineering I	6	0
6.021A	Circuit Theory I	0	4
10.1113	Pure Mathematics II — Multivariable Calculus	2½	0
10.1114	Pure Mathematics II — Complex Analysis	0	2½
		14½	12½

Stage 3

1.972	Electromagnetism	0	4
1.982	Solid State Physics	4	0
6.021B	Power	4	0
6.0311	Circuit Theory II	0	4
10.111A	Pure Mathematics II — Lineaar Algebra	2	2
10.2111	Applied Mathematics II — Vector Calculus	2½	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations	0	2½
	One General Studies Elective	1½	1½
		14	14

Stage 4

1.992	Thermal Physics & Mechanics†	4	0
6.056	Mechanical Engineering†	4	0
6.021C	Electronics I	4	0
6.021D	Computing	4	0
6.021E	Digital Logic & Systems	0	4
6.0312	Utilization of Electrical Energy	0	4
6.0313	Electronics II	0	4
	One General Studies Elective	1½	1½
		13½	13½

†Each student takes one of these technical electives.

Stage 5

6.0314	Systems & Control I	4	0
6.0315	Electrical Energy	0	4
6.0316	Electronics III	4	0
6.0317	Communication Systems I	0	4
10.361	Statistics SE	2	2
	One General Studies Elective	1½	1½
		11½	11½

Stage 6

	Four Professional Electives*	10	10
6.902	Industrial Experience		
6.921	Project**		

*The list of electives to be offered largely corresponds to those in Electrical Engineering IV list (see the BE degree program). The full range of electives are not offered in the BSc(Eng) degree course: students who can arrange the necessary day attendance may request approval to do other Electrical Engineering IV electives.

**6.921 Project: The project 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, this may require attendance at the University, full-time in final session, or one further part-time session.

Course Rules

It is the responsibility of students to meet the course requirements applicable at the date of application for the degree. Following each course revision, students will be assessed on the basis of the new program but:

- no students will lose credit for any subject completed,

and

- no students will be liable for increased requirements if they progress normally.

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

Re-enrolment

Students must collect enrolment information from the School Office before the end of Session 2 1979. Re-enrolment forms, giving details of students' proposed 1980 programs must be lodged with the School Office by Friday 4 January 1980. Enrolment at the University will not be authorized until the re-enrolment form has been checked and the program approved.

Electrical Engineering — 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* of 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 either the BE or BSc(Eng) degree as applicable.

Examples are:

(1) Replacement of two General Studies subjects by an approved Arts subject;

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

(3) If students proposing to attempt the BSc BE pattern include additional Computer Science, viz 6.641, or Applied Mathematics in their Year 2 Electrical Engineering program they open up a wider choice of subjects in their Science Year 3. Any subject omitted may be required to be taken in the student's Year 3 of Electrical Engineering.

(4) The normal Year 4 of the BE degree program includes 6 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.

(5) Students proposing to major in Computer Science in the BE program may substitute appropriate Science units in Year 3 (for one technical elective and 6.0315), and in Year 4 (for some professional electives).

Applications for substitution must be made by Friday 1 February 1980.

Double Degrees

3970/3640
Double Degree of BSc BE in Electrical Engineering

Students in Electrical Engineering may qualify for this double degree in five years of full-time study. Having completed the first and second year of the Electrical Engineering course, students *with a creditable performance* may transfer to the Science and Mathematics Course (this is subject to the recommendation of the Head of the School of Electrical Engineering *and* the approval of the Faculty of Engineering *and* the Board of Studies in Science and Mathematics). In the Science and Mathematics Course, students take the appropriate General Studies subjects and complete a specific course of study consisting of four Level III units chosen from related disciplines and no less than either four other Level II or Level III units. The specific courses of study available for this double degree are shown in the Combined Sciences Handbook and lead to majors in computing science, mathematics or physics. **Students contemplating this course should seek advice from the Head of School before completing their Year 2 enrolment.**

In their fourth year the students revert to the Faculty of Engineering. Depending on the program followed in their year in Science they will have already completed parts of the normal third year program 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. Students who choose to omit the two General Studies electives from their Year 3 program on this ground must still do a full year's work: that is, they would be expected to include some 6 session-hours of other material in lieu of the General Studies elective requirement. In their fifth year they will complete the fourth year of the Electrical Engineering course.

3720
Double Degree BA BE in Electrical Engineering

The double degree BA BE in Electrical Engineering may be gained by a five-year course of combined study. Students wishing to enrol for this double degree may do so: by initially enrolling as a student proceeding to the double degree, or by transferring to the BA BE program with advanced standing after partially completing the requirements or either degree, provided that suitable courses have been studied.

Any students wishing to enrol in, transfer into or continue in the double degree course BA BE shall have complied with all the requirements for prerequisite study and academic attainment (ie a creditable performance) of both the Faculties concerned. Students wishing to enrol in or to transfer into the double degree course may do so only after receiving the approval of the respective Deans of the Faculties of Arts and Engineering. Guidance should be sought from the School of Electrical Engineering, the relevant schools in the Faculty of Arts and the Arts Faculty Office.

Initial Enrolment for BA BE
A student enrolling initially for the double degree shall pursue a program for four years in which he completes subjects equivalent to 18 units in accordance with the regulations of the Faculty of Arts, provided that he includes: the subjects in Table A below, and a major sequence of subjects available within the Faculty of Arts (see that Faculty's regulations) in addition to his studies in the School of Mathematics. He shall also study concurrently subjects selected from Course 3640 in accordance with an acceptable program loading.

To complete his studies he must satisfy the requirements of a normal BE degree program in Electrical Engineering, less the General Studies subjects, one of the six units of Electrical Engineering IV, and one other subject approved by the Head of School of Electrical Engineering.

Table A*

10.001	Mathematics I	
10.111A	Pure Mathematics II (Linear Algebra)	
10.1113	Pure Mathematics II (Multivariable Calculus)	
10.1114	Pure Mathematics II (Complex Analysis)	
10.2111	Applied Mathematics II (Vector Calculus)	
10.2112	Applied Mathematics II (Mathematical Methods for Differential Equations)	
1.961	Physics I	or equivalent
1.972	Electromagnetism	
1.982	Solid State Physics	
1.992	Thermal Physics and Classical Mechanics	

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

The requirements of the appropriate Schools in respect of prerequisites, sequencing or substitutions shall be adhered to.

Subsequent Transfer to BA BE Course
Students wishing to pursue this route shall at the time of transfer and subsequently comply with the requirements for students initially enrolling in the double degree BA BE.

Honours Degree in Arts
Students wishing to gain an Honours degree in Arts as part of their combined BA BE double degree program shall meet all the relevant requirements of the Faculty of Arts and of the appropriate Schools. Such students may enrol for the Honours year in Arts only after receiving the approval of the respective Deans of the Faculties of Arts and Engineering.

School of Mechanical and Industrial Engineering

Head of School
Professor N. L. Svensson

Executive Assistant to Head of School
Associate Professor J. Y. Harrison

Senior Administrative Officer
G. Dusan

The courses in the School 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 either on a full-time basis, nominally over four years, or on a part-time basis, nominally over six years, or on a combined full-time/part-time basis, subject to the approval of the Head of School.

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

The study of the basic sciences — Mathematics, Physics and Chemistry — together with an introduction to Engineering, comprises the first year. Further mathematical studies are undertaken together with a study of the Engineering Sciences — Thermo-dynamics, Fluid Mechanics, Engineering Mechanics, Mechanics of Solids and their application in the field of Design.

The courses of Mechanical, Industrial and Aeronautical Engineering and of Naval Architecture have common subjects for the first two years if taken full-time, and for the first three years if taken part-time. 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 in the Mechanical Engineering Course may take, subject to the approval of the Head of School, up to six credits of graduate subjects per session 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 his final year and to deliver a short paper on the subject of his thesis. General Studies form a regular part of all courses. In certain instances and with permission from the Head of the School students may substitute an Arts subject in lieu of two General Studies subjects.

Industrial experience is an integral part of the courses. All students enrolled in the School must complete forty working days of approved industrial training between Years 2 and 3, also between Years 3 and 4 if taking the course on a full-time basis, and irrespective of their specialization, are strongly recommended to gain as much industrial training as possible between Years 1 and 2.

Students taking the course on a part-time basis must complete a total of eighty working days of approved industrial training in the period following the end of Year 3 up to the beginning of Year 6.

All students will be considered for the award of Honours which will be granted for meritorious performance in the course with particular emphasis on the later years.

Part-time courses of six years' duration leading to the degree of Bachelor of Science (Engineering) continue to be offered in the same four fields as the full-time courses, though no new enrolments are now accepted for these courses.

Students proceeding to the BSc(Eng) degree whether by a combination of part-time and of full-time study, or by part-time study alone, are required to undergo a minimum period of three years approved concurrent industrial training. (See also conditions for the award of the degree of BSc(Eng.) in the Calendar.)

Students should enrol in the subject 5.042 Industrial Experience in the year in which they expect to satisfy the requirement and, upon completion, submit to the School evidence from their employers of such industrial training.

The BSc(Eng) degree may be awarded 'With Merit' to students whose performance in the course is superior.

Students currently enrolled in the BSc(Eng) degree course may transfer, should they wish, to the corresponding BE degree course. Such students are given full credit for subjects they have already passed.

The award of the degree BE or BSc(Eng) in Mechanical Engineering is recognized by the Institution of Mechanical Engineers, London, as giving exemption from Parts I and II of the examinations required for admission to the grade of Member. Exemption from Part III (The Engineer in Society) of the examinations may also be granted, depending on the particular General Studies subjects taken. Exemption from Part III is considered on a case by case basis, and is not automatic. Specific enquiries on this matter should be addressed to the Head of the School.

The award of the degree of BE or BSc(Eng) in Industrial Engineering is similarly recognized by the Institution of Production Engineers, London.

The Institution of Engineers, Australia, grants full exemption from examinations for admission to the grade of Member to holders of the degree of BE or BSc(Eng) in any of the undergraduate courses offered by the School.

3680
Mechanical Engineering — Full-time (New Course)

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.951	Physics I (Mechanical Engineering)	4	4
2.951	Chemistry I (ME)	0	6
5.0101	Statics	4	0
5.061	Technical Orientation	2	0
5.121	Mechanical Engineering Design I	8	3
5.421	Mechanics of Solids I	0	4
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	23

An alternative 'science compatible' course which can be undertaken is as follows:

		Hpw	
1.001	Physics I *or*		
1.011	Higher Physics I	6	6
2.121	Chemistry IA	6	0
5.010	Engineering A	6	0
5.020	Engineering B	0	6
5.030	Engineering C (Production Technology Option)	0	6
5.061	Technical Orientation	2	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		26	24

Year 2

5.072	Statistics/Computing	2	3
5.122	Mechanical Engineering Design II	3	3
5.330	Engineering Dynamics I	2	2
5.422	Mechanics of Solids II/ Materials	4½	4½
5.622	Fluid Mechanics/ Thermodynamics	4	4
10.022	Engineering Mathematics II	4	4
18.020	Industrial Orientation	0	1
	General Studies Elective	1½	1½
		21	23

Year 3*

5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I†	0	0
5.073	Numerical Analysis/Mathematics	3	3
5.123	Mechanical Engineering Design III	3	3
5.333	Dynamics of Machines	0	3
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
	Two Fluid Mechanics/ Thermodynamics Technical Electives	3	3
6.854	Electrical Engineering	0	4
18.603	Management/Economics	4	0
	Two General Studies Electives	3	3
		22½	22½

*Not offered in 1980.
†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.

Year 4*

		Hpw S1	S2
5.044	Industrial Training II	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	1½	1½
		21½	21½

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 Inudstrial 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 are 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.
*Not offered in 1980.

3680
Mechanical Engineering — Full-time (Old Course)

Bachelor of Engineering
BE

Year 1*

		Hours per week S1	S2
1.951	Physics I (Mech. Eng.)	4	4
2.951	Chemistry I (ME)	0	6
5.010	Engineering A	6	0
5.030	Engineering C	6	0
5.040	Engineering D	0	8
5.061	Technical Orientation	2	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

Year 2*

5.032	Experimental Engineering II	2	2
5.111	Mechanical Engineering Design I	2	4
5.330	Engineering Dynamics	2	2
5.411	Mechanics of Solids II	2	2
5.611	Fluid Mechanics/ Thermodynamics	4	4
6.801	Electrical Engineering	3	3
8.259	Properties of Materials	3	3
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½
18.020	Industrial Orientation	0	1
		23½	26½

*Not offered in 1980.

Year 3

		Hpw		
5.033	Experimental Engineering III	1½		1½
5.043	Industrial Training I†	0		0
5.071	Engineering Analysis	3½		3½
5.112	Mechanical Engineering Design II	3		3
5.331	Dynamics of Machines I	2		2
5.412	Mechanics of Solids III	2		2
5.612	Fluid Mechanics/ Thermodynamics II	3½		3½
18.011	Industrial Engineering IA *or*			
18.021	Industrial Engineering IB	2		2
	General Studies Elective	3		3
6.853	Analogue & Digital Instrumentation*	3	*or*	3

†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.
*One session only. Students must take this subject in either Session 1 or Session 2.

Year 4

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.324	Automatic Control Engineering	3	3
	General Studies Elective	1½	1½

Plus 12 hours per week from the Mechanical Engineering Technical Elective List.

Note: Only a limited number of Technical Electives are 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.

3680
Mechanical Engineering — Part-time (New Course)

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.951	Physics I (Mechanical Engineering)	4	4
2.951	Chemistry I (ME)	0	6
5.0101	Statics	4	0
5.061	Technical Orientation	2	0
10.001	Mathematics I	6	6
		16	16

Year 2

		Hpw S1	S2
5.121	Mechanical Engineering Design I	8	3
5.421	Mechanics of Solids I	0	4
10.022	Engineering Mathematics II	4	4
5.330	Engineering Dynamics I	2	2
18.020	Industrial Orientation	0	1
	General Studies Elective	1½	1½
		15½	15½

Year 3*

5.072	Statistics/Computing	2	3
5.122	Mechanical Engineering Design II	3	3
5.422	Mechanics of Solids II/ Materials	4½	4½
5.622	Fluid Mechanics/ Thermodynamics I	4	4
	General Studies Elective	1½	1½
		15	16

*Not offered in 1980.

Year 4*

5.073	Numerical Analysis/Mathematics	3	3
5.123	Mechanical Engineering Design III	3	3
5.333	Dynamics of Machines	0	3
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
6.854	Electrical Engineering	0	4
	General Studies Elective	3	0
		14	15

*Not offered in 1980.

Year 5*

5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I	0	0
	Two Fluid Mechanics/ Thermodynamics Technical Electives	3	3
18.603	Management/Economics	4	0
	Technical Electives	6	6
	General Studies Elective	0	3
		14½	13½

*Not offered in 1980.

Year 6*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.344	Feedback Control	3	0
	Technical Electives	3	6
		14	14

*Not offered in 1980.

Note 1: By the end of Stage Six the equivalent of 10½ hours per week for a year of Technical Electives must have been completed. The equivalent of 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 Inudstrial 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 are 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.

3690
Mechanical Engineering — Part-time (Old Course)

Bachelor of Science (Engineering) BSc(Eng)

This course is of six years' duration, and leads to the degree of Bachelor of Science (Engineering).

Stage 1

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

*Not offered in 1980.

Stage 2

2.951	Chemistry I (ME)	0	6
5.010	Engineering A	6	0
5.030	Engineering C	6	0
5.040	Engineering D	0	8

Stage 3

5.330	Engineering Dynamics	2	2
5.411	Mechanics of Solids II	2	2
8.259	Properties of Materials	3	3
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½

Stage 4

5.032	Experimental Engineering II	2	2
5.111	Mechanical Engineering Design I	3	3
5.611	Fluid Mechanics/ Thermodynamics I	4	4
6.801	Electrical Engineering	3	3
	General Studies Elective	1½	1½

Stage 5

		Hpw S1	S2
5.071	Engineering Analysis	3½	3½
5.112	Mechanical Engineering Design II	3	3
5.331	Dynamics of Machines I	2	2
5.412	Mechanics of Solids III	2	2
5.612	Fluid Mechanics/ Thermodynamics II	3½	3½

Stage 6

5.042	Industrial Experience*	0	0
5.113	Mechanical Engineering Design III	6	6
5.324	Automatic Control Engineering	3	3
	General Studies Elective	1½	1½

Plus one of the following technical electives:

4.913	Materials Science *or*		
5.332	Dynamics of Machines II *or*	3	3
5.413	Mechanics of Solids IV		

*See the introduction of School of Mechanical and Industrial Engineering.

Mechanical Engineering Technical Elective List

Applied Mechanics Technical Electives

		Hpw		
5.321G	Analogue Control Systems	0		3
5.332	Dynamics of Machines II	3		3
5.334	Engineering Dynamics II	3	*or*	3
5.3541	Engineering Noise I	3		0
5.3542	Engineering Noise II	0		3

Mechanics of Solids Technical Electives

5.413.	Mechanics of Solids IV	3		3
5.417G	Mechanics of Fracture and Fatigue	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 Technical Electives

5.113	Mechanical Engineering Design III	6	6
5.124	Mechanical Engineering Design IV	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 Technical Electives

		Hpw S1		S2
5.614	Fluid Mechanics III	3		3
5.615	Thermodynamics III	3		3
5.623	Heat Transfer	3	*or*	3
5.624	Refrigeration and Air Conditioning	3	*or*	3
5.633	Turbomachines	3	*or*	3
5.634	Viscous Flow Theory and Lubrication	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

Other Technical Electives

4.913	Materials Science	3	3
5.074	Computing Science for Mechanical Engineers	3	0
5.811	Aerodynamics I	3	3
5.831	Aircraft Propulsion	2	2
18.012	Industrial Engineering IIA	3	3
18.022	Industrial Engineering IIB	3	3
18.431	Design for Production	3	3
18.551	Operations Research	3	3
23.051	Nuclear Power Technology	3	3

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

3610
Aeronautical Engineering — Full-time (New Course)

Bachelor of Engineering
BE

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

Year 3

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I†	0	0
5.073	Numerical Analysis/Mathematics	3	3

		Hpw S1	S2
5.303	Mechanical Vibrations	0	1½
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
5.800	Aircraft Design I	3	3
5.811	Aerodynamics I	3	3
5.822	Analysis of Aerospace Structures I	2	2
6.854	Electrical Engineering	0	4
18.603	Management/Economics	4	0
	Two General Studies Electives	3	3
		24½	23

*Not offered in 1980.
†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 II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design II	3	3
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
5.831	Aircraft Propulsion	2	2
	Technical Electives	3	3
	General Studies Elective	1½	1½
		22½	22½

*Not offered in 1980.
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. 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 are 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.

Year 3

		Hours per week S1		S2
5.033	Experimental Engineering III	1½		1½
5.043	Industrial Training I†	0		0
5.071	Engineering Analysis	3½		3½
5.303	Mechanical Vibrations	1½		0
5.412	Mechanics of Solids III	2		2
5.800	Aircraft Design I	0		2½
5.811	Aerodynamics I	3		3
5.822	Analysis of Aerospace Structures I	2		2
6.853	Analogue & Digital Instrumentation*	3	*or*	3
18.011	Industrial Engineering IA *or*	2		
18.021	Industrial Engineering IB			2
	General Studies Elective	3		3

*One session only. Students take this subject in either Session 1 or Session 2.
†Report to be submitted in Week 1 or Session 1 detailing involvement and experience gained prior to Year 3.

Year 4

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design	4	4
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
5.831	Aircraft Propulsion	2	2
	General Studies Elective	1½	1½
Plus one of the following technical electives:			
4.913	Materials Science *or*		
5.324	Automatic Control Engineering *or*		
8.026	Systems Methods in Civil Engineering *or*	3	3
18.022	Industrial Engineering IIB *or*		
18.551	Operations Research		
		23½	23½

3610 Aeronautical Engineering — Full-time (Old Course)

Bachelor of Engineering BE

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

3610 Aeronautical Engineering — Part-time (New Course)

Bachelor of Engineering BE

The first three years of this course are identical with the first three years of the part-time new course in Mechanical Engineering.

Year 4*

		Hours per week S1	S2
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 III	2	2
5.811	Aerodynamics I	3	3
6.854	Electrical Engineering	0	4
	General Studies Elective	1½	1½
		12½	15

*Not offered in 1980.

Year 5*

5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I	0	0
5.800	Aircraft Design I	3	3
5.822	Analysis of Aerospace Structures I	2	2
5.831	Aircraft Propulsion	2	2
18.603	Management/Economics	4	0
	Technical Electives	3	3
	General Studies Elective	0	3
		15½	14½

*Not offered in 1980.

Year 6*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design II	3	3
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
		16	16

*Not offered in 1980.

Note 1: The Technical Electives may be taken from the Mechanical Engineering or Industrial Engineering Technical Electives Lists 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 are 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.

3600
Aeronautical Engineering — Part-time (Old Course)

Bachelor of Science (Engineering) BSc(Eng)

This course is of six years' duration, and leads to the degree of Bachelor of Science (Engineering). The first four stages are identical with the Mechanical Engineering part-time old course.

Stage 5

		Hours per week S1	S2
5.071	Engineering Analysis	3½	3½
5.412	Mechanics of Solids III	2	2
5.811	Aerodynamics I	3	3
5.822	Analysis of Aerospace Structures I	2	2
5.303	Mechanical Vibrations	1½	0
		12	10½

Stage 6

5.042	Industrial Experience*	0	0
5.801	Aircraft Design	4	4
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
5.831	Aircraft Propulsion	2	2
	General Studies Elective	1½	1½
		12½	12½

*See the introduction to School of Mechanical and Industrial Engineering.

3700
Naval Architecture — Full-time (New Course)

Bachelor of Engineering BE

The first and second years of this course are identical with the first two years of the full-time new 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 institutions may be admitted to a two-year program leading to the Bachelor of Engineering degree in Naval Architecture.

Year 3*

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I†	0	0
5.073	Numerical Analysis/Mathematics	3	3
5.303	Mechanical Vibrations	0	1½
5.423	Mechanics of Solids III	2	2
5.901	Introduction to Mathematical Modelling and Decision Making	3	0
5.902	Ship Management Economics	1½	0
5.911	Ship Hydrostatics	2½	2½
5.921	Ship Structures I	2	2
5.9311	Principles of Ship Design I	0	3
5.953	Ship Hydrodynamics	3	2
6.854	Electrical Engineering	0	4
	Two General Studies Electives	3	3
		21½	24½

*Not offered in 1980.
†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 II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.922	Ship Structures II	2	2
5.9321	Principles of Ship Design II	4	2
5.937	Ship Design Project	3	4
5.941	Ship Propulsion and Systems	4	4
	General Studies Elective	1½	1½
		22½	21½

*Not offered in 1980.

3700
Naval Architecture — Full-time (Old Course)

Bachelor of Engineering
BE

The first and second years of this course are identical with the first two years of the full-time old 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 institutions may be admitted to a two-year program leading to the Bachelor of Engineering degree in Naval Architecture.

Year 3

		Hours per week S1	S2
5.033	Experimental Engineering III	1½	1½
5.043	Industrial Training I†	0	0
5.071	Engineering Analysis	3½	3½
5.303	Mechanical Vibrations	1½	0
5.412	Mechanics of Solids III	2	2
5.911	Naval Architecture	4	4
5.921	Ship Structures I	0	4
5.931	Principles of Ship Design IA	3	0
5.932	Principles of Ship Design IIA	0	2
5.951	Hydrodynamics	1½	0
18.021	Industrial Engineering IB	2	2
	General Studies Elective	3	3
		22	22

†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 II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.933	Principles of Ship Design III	3	3
5.934	Ship Design Project	3	4½
5.941	Ship Propulsion and Systems	4	4
	General Studies Elective	1½	1½
5.922	Ship Structures II	4	0
Plus one of the following technical electives:			
4.913	Materials Science *or*		
8.026	Systems Methods in Civil Engineering *or*	3	3
18.022	Industrial Engineering IIB *or*		
18.551	Operations Research		
		26½	24

3700
Naval Architecture — Part-time (New Course)

Bachelor of Engineering
BE

The first three years of this course are identical with the first three years of the part-time new course in Mechanical Engineering.

Year 4*

		Hours per week S1	S2
5.073	Numerical Analysis/Mathematics	3	3
5.423	Mechanics of Solids III	2	2
5.911	Ship Hydrostatics	2½	2½
5.921	Ship Structures I	2	2
5.953	Ship Hydrodynamics	3	2
	General Studies Elective	1½	1½
		14	13

*Not offered in 1980.

Year 5*

5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training	0	0
5.901	Introduction to Mathematical Modelling of Decision Makers	3	0
5.303	Mechanical Vibrations	0	1½
5.902	Ship Management Economics	1½	0
5.922	Ship Structures II	2	2
5.9311	Principles of Ship Design I	0	3
5.941	Ship Propulsion and Systems	4	4
6.854	Electrical Engineering	0	4
	General Studies Elective	3	0
		15	16

*Not offered in 1980.

Year 6*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.9321	Principles of Ship Design II	4	2
5.937	Ship Design Project	3	4
		15	14

*Not offered in 1980.

3710
Naval Architecture — Part-time (Old Course)

Bachelor of Science (Engineering) BSc(Eng)

This course is of six years' duration, and leads to the degree of Bachelor of Science (Engineering). The first four stages are identical with the Mechanical Engineering part-time old course.

Stage 5

		Hours per week S1	S2
5.071	Engineering Analysis	3½	3½
5.303	Mechanical Vibrations	1½	0
5.412	Mechanics of Solids II	2	2
5.911	Naval Architecture	4	4
5.921	Ships Structures I	0	4
5.931	Principles of Ship Design IA	3	0
		14	13½

Stage 6

5.042	Industrial Experience*	0	0
5.922	Ship Structures II	4	0
5.933	Principles of Ship Design III	3	3
5.934	Ship Design Project	3	4½
5.941	Ship Propulsion and Systems	4	4
	General Studies Elective	1½	1½
		15½	13

*See the introduction of School of Mechanical and Industrial Engineering.

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, nominally over four years or on a part-time basis, subject to approval by the Head of School.

The first two years of the degree course, taken full-time, or the first three years taken part-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. Finally, the problems associated with the practical economics of manufacturing operations are studied. These three fields of study provide the student with the training necessary to carry out an industrial job and to examine it critically in the light of economic efficiency.

Traditionally 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 in relation to buildings to permit efficient handling of materials; the avoidance or elimination 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 than an adequate profit can be obtained from it. A general working knowldge 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, finally, 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. Modern electronic computers may be called upon to help 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 incorporates also problems of equipment 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.

4. Methods Engineering

Methods engineering is particularly concerned with the co-ordination of men, materials and machines, so that an enterprise will run at maximum efficiency. A considerable knowledge of engineering in general, as well as an understanding of human factors and materials science, is necessary for methods engineering work. Time and motion study is part of methods engineering. In many cases the methods engineer works in close co-operation with the design department and executives engaged in industrial economic analysis.

5. Operations Research

This is the attack of modern science on complex problems arising in the direction and management of large systems of men, 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 — Full-time (New Course)

Bachelor of Engineering
BE

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

Year 3*

		Hours per week S1	S2
5.043	Industrial Training I†	0	0
6.854	Electrical Engineering	0	4
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	4	0
18.803	Optimization	3	0
	Two General Studies Electives	3	3
		24	22½

*Not offered in 1980.
†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.

Year 4*

		Hpw	
5.044	Industrial Training II	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	1½	1½
		21½	21½

*Not offered in 1980.

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 are 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.

Year 3

		Hours per week S1	S2
5.033	Experimental Engineering III	1½	1½
5.043	Industrial Training I†	0	0
5.071	Engineering Analysis	3½	3½
5.112	Mechanical Engineering Design II	3	3
5.331	Dynamics of Machines I	2	2
5.412	Mechanics of Solids III	2	2
14.001	Introduction to Accounting A	1½	0
14.002	Introduction to Accounting B	0	1½
18.011	Industrial Engineering IA	2	2
18.021	Industrial Engineering IB	2	2
	General Studies Elective	3	3
		20½	20½

†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 II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
18.012	Industrial Engineering IIA	3	3
18.022	Industrial Engineering IIB	3	3
18.431	Design for Production	3	3
18.551	Operations Research	3	3
	General Studies Elective	1½	1½
Plus one elective chosen from:			
4.913	Materials Science		
5.324	Automatic Control Engineering		
5.332	Dynamics of Machines II	3	3
5.413	Mechanics of Solids II		
8.026	Systems Methods in Civil Engineering		
		24½	24½

3660
Industrial Engineering — Full-time (Old Course)

Bachelor of Engineering
BE

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

3660
Industrial Engineering — Part-time (New Course)

Bachelor of Engineering
BE

The first three years of this course are identical with the first three years of the part-time new course in Mechanical Engineering.

Year 4*

		Hours per week S1	S2
6.854	Electrical Engineering	0	4
18.003	Numerical Methods/Industrial Experimentation	1½	2
18.403	Production Design and Technology	4	4
18.413	Design for Industrial Engineers	2	3
18.503	Operations Research A	3	3
18.803	Optimization	3	0
		13½	16

*Not offered in 1980.

Year 5*

5.043	Industrial Training I	0	0
14.001	Introduction to Accounting A	1½	0
14.002	Introduction to Accounting B	0	1½
18.004	Manufacturing Management	2	2
18.303	Methods Engineering	2	2
18.603	Management/Economics	4	0
	Technical Electives	5	5
	General Studies Elective	0	3
		14½	13½

*Not offered in 1980.

Year 6*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
	Technical Electives	5	5
	General Studies Elective	1½	1½
		15½	14½

*Not offered in 1980.

Note 1: By the end of Stage Six, the equivalent of 10 hours per week for a year of Technical Electives must have been completed. The equivalent of at least 6 hours per week for a year 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 are 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.

3670
Industrial Engineering — Part-time (Old Course)

Bachelor of Science (Engineering) BSc(Eng)

This course is of six years' duration, and leads to the degree of Bachelor of Science (Engineering). For outline of the first four stages see the Mechanical Engineering part-time old course.

Stage 5

		Hours per week S1	S2
5.071	Engineering Analysis	3½	3½
5.112	Mechanical Engineering Design II	3	3
5.331	Dynamics of Machines I	2	2
14.001	Introuction to Accounting A	1½	0
14.002	Introduction to Accounting B	0	1½
18.011	Industrial Engineering IA	2	2
18.021	Industrial Engineering IB	2	2
		14	14

Stage 6

5.042	Industrial Experience*	0	0
18.022	Industrial Engineering IIB	3	3
18.432	Design of Production Systems	6	6
18.551	Operations Research	3	3
	General Studies Elective	1½	1½
		13½	13½

*See the introduction of School of Mechanical and Industrial Engineering.

Industrial Engineering Technical Elective List

Production Engineering Technical Electives

		Hours per week S1		S2
18.204	Introduction to Automation I	3	*or*	3
18.214	Introduction to Automation II	3	*or*	3
18.224	Numerical Control of Machine Tools	3	*or*	3
18.404	Design for Production	2		2
18.262G	Economics of Machining for Automation	3	*or*	3
18.371G	Factory Design and Layout	3		0

Operations Research Technical Electives

		Hours per week S1		S2
18.671G	Decision Theory	2	*or*	2
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 Application of Mathematical Programming	2	*or*	2

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

School of Surveying

Head of School
Professor P. V. Angus-Leppan

Adminstrative Officer
J. V. Fonseka

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. 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 and resource assessment systems. The course recognizes the diversity of possible roles of a graduate who may be called on during his career to act as practitioner, consultant, manager, teacher or researcher.

The course has undergone comprehensive revision and 1979 and 1980 are the transition years in the implementation of the new course.

Features of the revisions include: retention of the course on a session basis for all subjects lectured within the School; integration of the sandwich course with the full-time course as a result of the more flexible University policy towards leave of absence for students; elimination of the formally assessed professional training period in the present course; greater numbers of technical electives in the fourth year of study; further development of the Land Studies area: land development, inventory, law, tenure, and utilization, in continuing recognition of the growing importance of this area to surveyors; development of a formal strand to improve students' written and spoken communication skills.

Throughout the course the 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 Bachelor of Surveying 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.

Students enrolled in the Bachelor of Surveying degree course are required to equip themselves with an electronic calculator. Details of the features required are available from the School.

3740
Surveying — Full-time Course

Bachelor of Surveying
BSurv

Year 1

Session 1		Hours per week
1.971	Physics I	6
5.0102	Introduction to Engineering Design	2
10.001	Mathematics I	6
29.001	Surveying I	4½
29.800	Survey Draughting	3
29.700	Professional Orientation*	1½
29.191	Survey Camp I†	1½
		24½

*Three half-day excursions are an essential part of this subject.
†Students are required to attend a one-week Survey Camp equivalent to 1½ class contact hours per week in each session.

Session 2

		Hpw
1.971	Physics I	6
5.030	Engineering C*	6
10.001	Mathematics I	6
29.002	Surveying II	5
29.191	Survey Camp I†	1½
		24½

*Introduction to Systems and Computers option.
†Students are required to attend a one-week Survey Camp equivalent to 1½ class contact hours per week in each session.

Year 2

Session 1

1.962	Physics of Measurement	3
10.022	Engineering Mathematics II (1st part)	4
10.341A	Statistics SU	2
27.295	Physical Geography for Surveyors†	4
29.003	Surveying III	5
29.151	Survey Computations I	4
29.192	Survey Camp II*	1½
		23½

*Students are required to attend a one-week survey camp, which is equivalent to 1½ class contact hours per week in each session.
†One-day field tutorial is an essential part of this course.

Session 2

8.711	Engineering for Surveyors I	3
10.022	Engineering Mathematics II (2nd part)	4
10.341B	Statistics SU	2
29.004	Surveying IV	4½
29.801	Cartography I	3
29.701	Seminar I	1
29.121	Electronics for Surveyors	2
29.192	Survey Camp II*	1½
	General Studies Elective	3
		24

*Students are required to attend a one-week survey camp, which is equivalent to 1½ class contact hours per week in each session.

Year 3

Session 1

8.712	Engineering for Surveyors II	3
29.005	Surveying V	5
29.152	Survey Computations II	4
29.651	Land Development I	3
29.661	Cadastral Surveying and Land Law I	2
36.411	Town Planning	2
	General Studies Elective	3
		22

Session 2

		Hpw
29.006	Surveying VI	3
29.211	Geodesy I	4
29.311	Astronomy I	3
29.511	Photogrammetry I	4
29.652	Land Development II	3
29.631	Land Inventory I	2
29.662	Cadastral Surveying and Land Law II	3
29.195	Survey Camp III**	6
		28

**Students are required to attend a two-week survey camp, which is equivalent to 6 class contact hours per week.

Year 4

Session 1

29.212	Geodesy II	3
29.312	Astronomy II	2
29.512	Photogrammetry II	3
29.653	Land Development III	3
29.704	Management I	2
29.702	Seminar II	1
	Electives*	6
29.196	Survey Camp IV**	6
		26

*See Year 4: Electives, immediately below.
**Two weeks of office computations equivalent to 6 class contact hours per week.

Session 2

29.705	Management II	2
29.703	Seminar III	1
	Electives*	15
		18

*See Year 4: Electives, immediately below.

Year 4: Electives

Total of two General Studies Advanced Electives and five technical electives in any combination which results in 6 hours for Session 1 and 15 hours for Session 2. Technical electives (of 3 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	Charactistics of Modern Theodolites and Levels
29.034	Mine Surveying
29.035	History of Surveying
29.153	Adjustment of Control Surveys
29.161	Hydrographic Surveying I
29.162	Hydrographic Surveying II
29.173	Project
29.174	Major Project (6 hours per week)
29.213	Geodesy III
29.231	Geophysics for Surveyors
29.232	Atmospheric Effects on Geodetic Measurement

29.313 Astronomy III
29.513 Photogrammetry III
29.514 Remote Sensing Principles
27.043 Remote Sensing Applications
29.654 Land Development IV
29.632 Land Inventory II
29.663 Cadastral Surveying and Land Law III
29.664 Modern Title Concepts
29.802 Cartography II
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.

Transitional arrangements in 1980 for students who wish to graduate under the old course.

Part 8† (Old Course)

		Hpw
29.006	Surveying VI	3
29.212	Geodesy II	3
29.312	Astronomy II	2
29.512	Photogrammetry II	3
29.653	Land Development III	3
29.662	Cadastral Surveying and Land Law II	3
29.704	Management I	2
29.196	Survey Camp II**	
	Two Electives*	6
		25

†Offered in Session 1, 1980 only.
**Two weeks of office computations equivalent to 84 class contact hours.

Electives chosen from:

29.161 Hydrographic Surveying I
29.173 Project
29.514 Principles of Remote Sensing
29.802 Cartography II
29.034 Mine Surveying

Graduate Study

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1980 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1980* 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 Council approved the establishment of the Graduate School of Engineering to co-ordinate and develop the graduate activities of the Faculty. For full details of such activities see brochures prepared by the Schools.

Research Degrees

The Faculty of Engineering provides facilities for well-qualified graduates to engage in advanced studies and research in all six schools, leading to the award of the degrees of Doctor of Philosophy, Master of Engineering, Master of Science or Master of Suveying.

Course Work Degrees

The Master of Engineering Science/Master of Surveying Science are faculty-wide degrees, and allow for flexibility of choice between formal course work and research. A degree may be awarded through formal course work, a combination of formal course work and the completion of a report on a project or a research thesis, or completion of a research thesis only. The number of credits for a project report are 9, and for a research thesis 18 or 36.

Students are encouraged to develop interdisciplinary attitudes and, with the approval of the Heads of the School, may take subjects from other schools of the Faculty, other Faculties of the University and other universities or institutions. By means of this system, a student, with approval of the Head of School, is able to select a program of studies best suited to his or her needs.

A minimum of thirty-six credits is required for the award of the Master of Engineering Science and Master of Surveying Science degrees in the Faculty.

Part-time candidates may be required to attend lectures on one half day per week in addition to the evenings.

The degree of Master of Biomedical Engineering is primarily obtained through course work but includes a research project conducted in either a hospital or other appropriate institution. The program of study, including the preparation of a thesis normally total 60 credit points. Students with advanced standing may be given limited exemption by the Higher Degree Committee of the Faculty of Engineering.

Graduate Diploma

The Faculty of Engineering also offers courses leading to the award of a graduate diploma in several areas. Currently these

are Graduate Diplomas in Engineering Developments; in Highway Engineering; in Human Communication; in Industrial Engineering; and in Transport. Candidates must complete a program totalling 30 credits. Forty percent of the credits 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.

Before enrolment, an applicant must submit his intended program for approval by the head of the school or division which will offer the majority of the credits and ensure that he has the necessary prerequisite background for any subjects taken in other schools, faculties or institutions.

The program may be taken full-time, part-time or externally by tape correspondence or by a combination of these.

The purpose of offering these graduate diplomas is to provide engineers with the opportunity to update their professional knowledge in their own speciality, and to have access to a program of study in other areas which are relevant to their professional activities by virtue of changes and developments that are occurring. The subjects offered have been specially chosen for these purposes and many of them are available by radio and television broadcasts in the Sydney metropolitan area from year to year.

The graduate diploma course in Engineering Developments is intended for those who wish to take a more general program in several areas of interest. It may contain subjects from the Division of Postgraduate Extension Studies (by radio, tape correspondence, etc) and elsewhere. Subjects offered by tape correspondence are listed in this handbook under the Division of Postgraduate Extension Studies. Subjects from other schools to be offered in any year by the Division of Postgraduate and Extension Studies are determined after consultation with that school and examination will be through that school.

Graduate Subjects

The subjects which may be available for candidates proceeding to the degree of Master of Engineering 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.

School of Civil Engineering

		Credits
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
8.710G	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
8.748G	Pavement Materials I	3
8.749G	Pavement Materials II	3
8.750G	Pavement Design and Evaluation I	3
8.751G	Pavement Design and Evaluation II	3
8.752G	Terrain Engineering	6
8.753G	Soil Engineering	3
8.754G	Applied Soil Mechanics	3
8.755G	Materials of Construction (Concrete Technology) I	3
8.756G	Materials of Construction (Metals and Plastics)	3
8.758G	Soil Mechanics	3
8.759G	Rock Mechanics	6
8.760G	Materials of Construction (Concrete Technology) II	3
8.764G	Composites in Civil Engineering	3
8.766G	Welding in Structural Engineering	3
8.771G	Foundation Engineering	6
8.772G	Soil Dynamics and Earthquake Analysis	6
8.780G	Geological Engineering	3
8.802G	Elastic Stability I	3
8.803G	Elastic Stability II	3
8.804G	Vibration of Structures I	3
8.805G	Vibration of Structures II	3
8.806G	Prestressed Concrete I	3
8.807G	Prestressed Concrete II	3
8.808G	Prestressed Concrete III	3
8.809G	Reinforced Concrete I	3
8.810G	Reinforced Concrete II	3
8.811G	Reinforced Concrete III	3
8.812G	Plastic Analysis and Design of Steel Structures I	3
8.813G	Plastic Analysis and Design of Steel Structures II	3
8.814G	Analysis of Plates and Shells	3
8.817G	Experimental Structural Analysis I	3
8.818G	Bridge Design I	3
8.819G	Bridge Design II	3
8.820G	Structural Analysis and Finite Elements I (SAFE I)	3

		Credits
8.821G	Structural Analysis and Finite Elements II (SAFE II)	3
8.822G	Structural Analysis and Finite Elements III (SAFE III)	3
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 I	3
8.836G	Coastal Engineering II	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
8.847G	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
8.853G	Public Health Science	6
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 I	3
8.861G	Investigation of Groundwater Resources II	3
8.862G	Fluvial Hydraulics	3
8.863G	Estuarine Hydraulics	3
8.901G	Civil Engineering Elective I	3
8.902G	Civil Engineering Elective II	3
8.909G	Project	9
8.918G	Research Project	18
8.936G	Research Project*	36

*A 36 Credit Research Project is not normally approved in the School of Civil Engineering. The normal program includes a 9 Credit Project.

School of Electrical Engineering

Each subject (except 6.909G, 6.918G, 6.936G and 6.339G) counts as three credits. (6.339G* is 6 credits.)

6.050G Occasional Elective
6.053G Advanced Mathematics II
6.054G Numerical Computation
6.071G Electrical Measurements
6.073G Precise Electrical Measurements
6.074G Superconductivity
6.075G Electric Contacts
6.150G Communication Elective
6.160G Field Theory in Electrical Engineering
6.161G Field Mapping
6.164G Microwave Antenna Theory and Applications
6.169G Microwave Circuits: Theory and Techniques
6.170G Microwave Electronics
6.224G Electrical Insulation Engineering
6.225G Electrical Discharges and their Technical Applications
6.226G Electrical Apparatus Design
6.227G Assessment of Insulation Performance in Electrical Plant
6.228G Power System Equipment
6.234G Power System Protection
6.244G Power Systems I
6.246G Power System Operation and Control
6.247G Power System Analysis
6.248G Power System Planning
6.249G Dynamic Performance of Power Systems
6.250G Power Elective I
6.251G Power Elective II
6.254G Electrical Machines I
6.255G Electrical Machines II
6.256G Underground Systems
6.257G Electric Power Distribution Systems
6.336G Digital Communication Networks
6.337G Sound Broadcast Systems
6.338G Television Systems
*6.339G Electroacoustics
6.344G Communication Theory
6.345G Analogue and Digital Filters
6.347G Digital Communications
6.348G Optical Communications
6.349G Radar and Navigation Aids
6.350G Solid State Electronics Elective
6.373G Semiconductor Devices
6.375G Integrated Circuit Technology
6.376G Reliability Engineering
6.377G Integrated Circuit Design
6.378G Solar Energy Conversion
6.379G Solar Cells — Operating Principles, Technology and System Applications
6.380G Data Acquisition and Analysis in Remote Sensing.
6.452G Principles of Feedback Control
6.453G Computer Methods of Optimization
6.455G System Identification and Modelling
6.456G General Concepts in Formal System Theories
6.458G Decision and Syntactic Systems for Digital Pattern Recognition
6.459G Control Computing
6.460G Real Time Computing
6.464G Applied Optimal Estimation and Prediction
6.466G Computer-Aided Design of Multivariable Control Systems
6.467G Digital Image Processing Systems, Scene Analysis and Machine Vision
6.468G Computer Display Systems and Interactive Instrumentation
6.470G Advanced Topics in Control
6.471G Systems and Control Elective
6.484G Biological Signal Analysis
6.485G Medical Instrumentation

6.650G	Computer Science Elective	
6.651G	Digital Electronics	
6.654G	Digital Systems	
6.655G	Computer Organization and Architecture	
6.656G	Software Systems A	
6.657G	Software Systems B	
10.061G	Advanced Mathematics I	
10.361G	Statistics	
†6.909G	Project	9 credits
6.918G	Research Project	18 credits
6.936G	Research Project	36 credits

†Nine credit projects are not normally approved by the School of Electrical Engineering.

		Credits
*5.751-2G	Regrigeration, Air Conditioning and Cryogenics I, II	2,2
*5.758G	Refrigeration and Air Conditioning Applications	4
5.909G	Project	9
5.912-3G	Naval Hydrodynamics I, II	2,2
5.918G	Research Project	18
†5.936G	Research Project	36

*Candidates wishing to specialize in Refrigeration and Air Conditioning should select these subjects.
†A 36 credit Research Project is not normally approved in the School of Mechanical and Industrial Engineering.

School of Mechanical and Industrial Engineering

		Credits
5.045-6-7G	Advanced Topics in Mechanical Engineering	2,2,2
5.073G	Ordinary Differential Equations in Mechanical Engineering	3
5.075-6G	Computation Methods in Mechanical Engineering I, II	2,2
5.077-8G	Analogue Computation in Mechanical Engineering I, II	2,2
5.086G	Digital Logic Fundamentals for Mechanical Engineers	3
5.087G	Microprocessor Fundamentals for Mechanical Engineers	3
*5.151-2G	Refrigeration and Air Conditioning Design I, II	3,3
5.304-5G	Advanced Dynamics I, II	2,2
5.315-6G	Mechanisms I, II	2,2
*5.321-2G	Automatic Control I, II	2,2
5.328-9G	Control and Modelling of Mechanical Systems I, II	2,2
5.335G	Vibrations	2
5.336G	Random Vibrations	2
5.401G	Experimental Stress Analysis	2
5.415-6G	Stress Analysis for Mechanical Engineering Design I, II	3,3
5.417G	Mechanics of Fracture and Fatigue	3
5.428G	Advanced Mechanics of Materials	2
5.491-2G	Biomechanics I, II	2,2
5.615G	Reciprocating Internal Combustion Engines	2
5.621-2G	Gasdynamics I, II	2,2
5.631-2G	Lubrication Theory and Design I, II	2,2
5.653-4G	Acoustic Noise I, II	2,2
*5.712-3G	Convection Heat Transfer I, II	2,2
5.718G	Conduction Heat Transfer	2
5.719G	Radiation Heat Transfer	2
5.720G	Solar Collector Systems	2
5.725G	Statistical Thermodynamics	2
5.735G	Direct Energy Conversion	2

Department of Industrial Engineering

		Credits
*18.061G	Industrial Experimentation I	3
*18.062G	Industrial Experimentation II	3
*18.073G	Ergonomics	2
18.074G	Industrial Management	3
*18.171G	Inspection and Quality Control	3
*18.260G	Computer Aided Programming for Numerical Control	3
*18.261G	Computer Automation	3
*18.262G	Economics of Machining for Automation	3
*18.271G	Theory of Machining and Forming Processes	3
*18.272G	Technology of Machining and Forming Processes	3
*18.370G	Design of Work Systems	3
*18.371G	Factory Design and Layout	3
*18.461G	Design for Production	4
*18.462G	Industrial Design	2
*18.463G	Tool Design	4
*18.464G	Value Analysis/Engineering	3
*18.471G	Design Communication	2
*18.472G	Engineering Design Analysis	6
18.571G	Operations Research I	6
18.574G	Operations Research II	3
18.579G	Case Studies in Operations Research	3
18.671G	Decision Theory	2
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
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

		Credits
18.778G	Scheduling and Sequencing	2
18.779G	Game Theory	2
18.862G	Linear Programming	2
18.863G	Non-Linear Programming	2
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
18.877G	Large-scale Optimization	2
18.878G	Industrial Applications of Mathematical Programming	2
18.879G	Mathematical Programming Analysis	3
18.960G	Production Engineering 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
18.977G	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	Research Project	18
†18.936G	Research Project	36

Note 1: Candidates taking their Project in Industrial Management are generally required to take 18.074G, 18.370G, 18.571G, 18.675G and 14.062G Accounting for Engineers. Before enrolling in the Project they must have had one year's relevant industrial experience and have access to industry for their Project topic.

Note 2: Candidates taking their Project in Operations Research are generally required to take 18.571G, 18.574G, 18.871G and 14.062G Accounting for Engineers.

*Candidates with a Project in Production Engineering are generally required to take at least two-thirds of the formal credits from these subjects.

†A 36 credit Research Project is not normally approved in the School of Mechanical and Industrial Engineering.

School of Nuclear Engineering

Head of School
Professor J. J. Thompson

Each subject counts as three credits.

23.013G	Neutron Transport and Diffusion
23.014G	Fewgroup Reactor Theories
23.015G	Multigroup Reactor Theories
23.016G	Neutron Kinetics and Reactor Dynamics
23.023G	Reactor Thermal Performance
23.024G	Boiling and Two Phase Flow
23.025G	Reactor Structural Mechanics
23.026G	Reactor Systems Analysis
23.027G	Boiling Reactor Dynamics
23.028G	Reactor Accident and Safety Analysis
23.032G	Mathematics Analysis and Computation
23.033G	Matrix Theory and Computation
23.034G	Random Processes and Reactor Noise
23.042G	Nuclear Fuel and Energy Cycles
23.043G	Nuclear Power Costing and Economics
23.044G	Nuclear Engineering Optimization
23.045G	Uranium Enrichment Technology
23.909G	Project 9 credits
23.918G	Research Project 18 credits
23.936G	Research Project 36 credits

School of 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 I — Numerical Analysis	3
29.172G	Mathematical Methods II — Statistical Theory of Survey Observations	3
29.173G	Mathematical Methods III — Spherical Harmonics	3
29.174G	Mathematical Methods IV — Theory of Survey Adjustment	3
29.175G	Mathematical Methods V — Collocation	3
29.201G	Geodetic Methods	3
29.202G	Solid Earth, Ocean, Lunar and Planetary Geodesy	3
29.203G	Gravimetric Geodesy	3
29.204G	Geodetic Refraction	3
29.205G	Geodetic Analysis Techniques	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
29.706G	Survey Management	3
29.707G	Quantitative Management Methods	3
29.909G	Project	9
29.918G	Research Project	18
29.936G	Research Project	36

School of Transport and Highways

Head of School
Professor W. R. Blunden

		Credits
24.001G	Human Factors in Transport	3
24.002G	Transport, Environment, Community	6
24.003G	Theory of Land Use/Transport Interaction	3
24.004G	Local Area Transport Planning	3
24.005G	Urban Transport Planning Practice	3
24.006G	Regional Transport Planning	3
24.007G	Transport System Design (Non-Urban)	3
24.008G	Transport System Design (Urban)	3
24.009G	Interchange Design	3
24.010G	Highway Engineering Practice Part I	3
24.011G	Highway Engineering Practice Part II	3
24.012G	Economics for Transport Studies	3
24.013G	Transport Economics	3
24.014G	Transport Systems Part I	3
24.015G	Transport Systems Part II	3
24.016G	Traffic Engineering	6
24.017G	Transport and Traffic Flow Theory	6
24.018G	Statistics for Transport Studies Part I	3
24.019G	Statistics for Transport Studies Part II	3
24.020G	Mathematical Techniques for Transport Studies	3
24.021G	Law and Administration	3
24.022G	Pavement Materials I	3
24.023G	Pavement Materials II	3
24.024G	Pavement Design and Evaluation I	3
24.025G	Pavement Design and Evaluation II	3
24.026G	Bridges and Highway Structure Part I	3
24.027G	Bridges and Highway Structure Part II	3
24.028G	Transport and Highways Elective	3
24.909G	Project	9
24.918G	Research Project	18
24.936G	Research Project	36

Centre for Biomedical Engineering

Director
Associate Professor P. C. Farrell

		Credits
32.011	Biomedical Statistics	4
32.010G	Biomedical Engineering Practice	2
§32.018G	Research Project	18
32.020G	Radiation Physics	4
§32.030G	Research Project	30
32.311G	Mass Transfer in Medicine	4
32.321G	Fluid Mechanics for Artificial Organs	4
32.331G	Biocompatibility	2
*32.500G	Computing for Biomedical Engineers	3
32.510G	Introductory Biomechanics	3
32.511G	Mechanics of the Human Body	4
†32.521G	Biomechanics of Physical Rehabilitation	4
†32.531G	Mechanical Properties of Biomaterials	4
32.611G	Medical Instrumentation	3
32.612G	Biological Signal Analysis	3
*32.621G	Medical Electronics	3

*For medical graduates only.
†Only one of these subjects is offered.
§Research project may be done concurrently with course work during the other 2/3 sessions. An 18 credit project is the normal requirement.

Graduate Diplomas

In all schools of the Faculty subjects listed above may be included in Graduate Diploma Programs. In addition the following subjects are offered specifically for Graduate Diploma students. Not all electives are necessarily offered in any particular year.

School of Electrical Engineering

		Credits
6.060G	Microprocessor Systems	3
6.167G	Propagation and Transmission of Electrical Waves	3
6.340G	Communications Electronics	3
6.341G	Signal Analysis	3
6.343G	Digital and Analogue Communications	3
6.457G	Cybernetic Engineering	3
6.481G	Biology and Physiology for Engineers	3
6.659G	Date Bases and Networks	3
6.660G	Programming II	3
6.661G	Business Information Systems	3
6.662G	Computing Practice	3

School of Mechanical and Industrial Engineering

		Credits
18.080G	Organization and Administration	2
18.083G	Industrial Studies	2
18.084G	Industrial Applications of Probability Theory	4
18.380G	Methods Engineering	4
18.580G	Operations Research	6
18.680G	Decision Making Under Uncertainty	2
18.681G	Engineering Economic Analysis	3
18.780G	Production Control	2
14.001 / 14.002	Introduction to Accounting A / Introduction to Accounting B	3
14.042G	Industrial Law	2
14.062G	Accounting for Engineers	3

School of Transport and Highways

		Credits
24.101G	Characteristics of Transport	6
24.102G	Fundamentals of Transport Economics	6
24.103G	Introduction to Statistics	6
24.104G	Introduction to Traffic Theory	6
24.105G	Fundamentals of Transport Planning	6
24.106G	Traffic Operation and Control	6
24.107G	Soil Mechanics applied to Road Engineering	8
24.108G	Road Engineering Practice	8
24.109G	Road Location and Design Part I	7
24.110G	Road Location and Design Part II	7
24.111G	Road Construction	6
24.112G	Highway Materials	6
24.113G	Transport and the Environment	6

Division of Postgraduate Extension Studies* Human Communication

The following subjects are offered by a combination of attendance at the Kensington campus for studio, laboratory and tutorial sessions and lectures by radio in the Sydney area and by audio tape elsewhere.

		Credits
97.001G	Linguistics and Written and Spoken Communication	2
97.002G	Basic Information Theory	6
97.003G	Human Transformation	6
97.004G	Psychology of Communication	3
97.005G	Audio and Video Equipment — Capabilities and Applications	4
97.007G	Audio Video Signals in Communication	3
97.008G†	Body in Communication	2
97.010G	Basic Fortran	2
97.012G	Project	5
97.013G	Presentation of Information	3
97.345G	Active and Adaptive Circuits	3

*See the Calendar for further information on the Division of Postgraduate Extension Studies.
†Half-session only.

Subjects offered by Tape Correspondence

		Credits
5.075G	Computational Methods in Mechanical Engineering, Part I	2
5.076G	Computational Methods in Mechanical Engineering, Part II	2
6.373G	Semiconductor Devices	3
6.376G	Reliability Engineering	3
6.377G	Integrated Circuit Design	3
6.378G	Solar Energy Conversion	3
6.379G	Solar Cells — Operating Principles, Technology and System Applications	3
6.490G	Using Microprocessors in Real-time Applications	2
8.708G	Finite Element Methods in Civil Engineering	3
97.010G	Basic Fortran	2
97.031G	Linguistics, and Written and Spoken Communication	1
97.032G	Basic Information Theory	1
97.034G	Psychology of Communication	2
97.035G	Audio Video Equipment	2
97.037G	Audio Video Signals in Communication	1
97.038G	Body in Communication	1
97.043G	Presentation of Information	1
97.345G	Active and Adaptive Circuits for Integrated Systems	3

Projects and Research Projects

Supervision of projects and research projects will generally be available in 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.
Structure — foundation interaction analysis for space frames supported on a raft foundation.
Stabilization of acidic soils.
Deformation and failure of soil under three dimensional stress state (experimental).

Influence of defects on strength and deformation of rocks.
Theoretical and experimental studies of blasting hard rocks.
Foundations subject to dynamic loading.
Tensile creep of concrete.
Influence of admixtures on creep and shrinkage of concrete.
Magnitude and distribution of cracks in reinforced concrete beams.
Creep of wood.
Analytical and experimental study of fibre reinforced plastics.

Hydrology

Flood estimation.
Yield and reservoir studies.
Hydrological instrumentation and data collection.
Mathematical rainfall-runoff models.
Stochastic hydrology.
Hydrometeorology.

Hydraulics

Two-fluid systems with small density differences.
Sediment motion.
Air entrainment in water in open channel flow.
Wave action and coastal engineering.
Flow through porous media.
Hydraulic transportation of solids.

Public Health Engineering

Sewage sludge conditioning and filtration.
Desalination of water.
Clarifiers and sedimentation in water and waste water treatment.
Filtration.
Water-oil separation by flotation and skimming.

Reinforced Concrete Structures

Torsion, bending and shear in reinforced concrete and prestressed concrete beams.
Creep and shrinkage effects in reinforced concrete structures.
Characteristics of plastic hinges.

Structural Analysis

Development of computer methods for analysis of multistorey flat plate structures.
Development and application of finite element techniques.
Investigation of elastic stability.
Analysis of dynamic response of highway bridges and buildings.

Water Resources Engineering

Multi-objective water resources planning.
Hydro-economic studies.
Optimization problems in water resource systems design.

Electrical Engineering

Communications

Communication theory and system theory.
Digital communication systems.
Digital signal processing and filtering.
Active and adaptive circuits.
Computer modelling for system design.
Microprocessor applications.
Microwave integrated circuits.
Adaptive antenna arrays.
Optical communications, optical fibre studies and measurements.
Solid state devices including surface elastic wave devices.
Acoustics and psychoacoustics. Hearing aid development.
Electronic music.
Seismic signal processing.

Systems and Control

Analysis and design of non-linear systems.
Structural problems in identification, especially feed-back problems.
Numerical methods of optimization including large scale systems.
Deterministic and stochastic control, self tuning regulators.
Cybernetics.
Computer aided design including linear and non-linear simulations, MIMO frequency domain design.
Biological signal analysis and system modelling.
Application of the above ideas including: control of a cement kiln; boiler identification and control; reactor boiling channel identification; grit analysis; pattern recognition; fermentation process control; computer control and instrumentation; microprocessors; electric car control.

Electric Power

The stability, dynamics and control of electric power systems.
Instrumentation and protection in power systems.
Power system security and on-line security analysis.
Applications of field theory.
Electrical measurements.
Superconductivity.
Electrical machines and thyristor control schemes.

Special Electrical machines.
Power electronics.
Electric vehicles.
High voltage and heavy current phenomena.
Electrical discharges and their uses.
Insulation research including partial discharges.
Data acquisition and transmission and switching control in power systems.

Computer Science

Extensible Computer systems.
Real time incremental computing systems.
Observable computer systems.
Algorithms for industrial scheduling.
Artificial intelligence.
Digital systems description, specification and design.
Commercial software engineering.
Operating systems.
Microprocessor development systems.

Solid State Electronics

Semiconductor device physics.
Integrated circuit design.
Integrated circuit technology.
Surface elastic wave devices.
Reliability engineering.
Photovoltaic solar energy conversion.
Ultrasonic holography.
Optoelectronic devices.
Periodically parametric systems.

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 mechanisms.
Dynamics of machines.
Multi-mode vibrations.
Lubrication and wear.
Computer aided design.
Plastic deformation.

Fluid Mechanics/Thermodynamics — including Aeronautical Engineering and Naval Architecture

Two-phase flow with and without hear transfer. Slurries.
Hydraulic transients.
Hydrodynamics, water hammer. Fluidics.
Conduction, convection and radiation. Natural convection.
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.
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 planning surfaces.

Industrial Engineering — including Operations Research and Production Engineering

Engineering economic analysis.
Efficiency of production lines.
Optimum length of 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, identation, 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.
Social psychology in industry.
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.
Reactor channel hydrodynamics.
Boiling and two-phase flow.
Nuclear reactor dynamics, stability and control.
Numerical methods for reactor analysis and simulation.
Nuclear power planning and reactor strategy.
Optimization and optimal control in nuclear engineering.
Structural mechanics in reactor technology.
Laser-plasma interaction.
Risk assessment.

Surveying

Adjustments and Error Theory

Applications in geodetic surveying and photogrammetry.
Solution of large systems of equations.
Computation systems for desk top computers.

Land Studies

Land tenure, registration and survey systems.
Integrated survey systems.
Land data banks, spatial information systems.
Land development.
Residential value models, mass valuation techniques.

Geodesy

Physical geodesy, geoid and gravimetric studies, Earth models.
Satellite geodesy, precise orbit determinations, satellite altimetry analysis.
Remote sensing ocean dynamics from satellites, sea surface topography, unification of vertical datums.
Applications of lunar laser ranging and very long baseline interferometry in polar motion and earth rotation.
Systems design for secular geodynamics from geodetic observations.
Geometric geodesy and geodetic surveying, use of Doppler systems in regional geodesy, geodetic astronomy.
Effects of atmosphere on distance and angular measurements, micrometeorological studies.

Photogrammetry

Production and evaluation of orthophotos and other map products.
Cartographic enhancement of orthophoto maps.
Monocular and stereoscopic pointing to photographic images, applications to ground targets, instrument cursors, cartographic symbolization.
Geometry of image sensors, remote-sensing imaging devices, mapping from panoramic photographs.
Non-topographic applications.
Restoration of digital image data.
Accuracy limitations of analogue stereoplotters.
Aerotriangulation, computer applications, block adjustment, independent model triangulation.
Digital terrain models.

Precise 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.

Transport and Highways

The testing of aggregates.
The properties of pavement materials subjected to repeated loading.
The surface texture of aggregates.
The stability of bituminous mixes.
The testing of full scale pavement systems.

The effects of porosity on the properties of rocks and road making aggregates.
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.
Problems of land use and transport interaction.
Theories of traffic structure and flow.
Measurements, planning and control of traffic.
Transport systems analysis.
Investigation of human factors.
Economic evaluation of transport investments.
Transport planning — urban systems.
Investigations into transport economics and policy.
Design of information systems.

Biomedical Engineering

Modelling of respiratory function, cardiac 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 analyses of wave forms from medical diagnostic equipment.
Implants for fracture support and joint replacement.

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 Table (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: Faculty Table (Graduate Study)** in the Calendar.

For the statements **Preparations and Submissions of Project Reports and Theses for Higher Degrees** *and* **Policy with respect to the use of Higher Degree Theses** see the Calendar.

Higher Degrees

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine in the Faculty of Medicine	MD	Calendar Medicine
Doctor of Philosophy	**PhD**	Calendar and **all faculties**
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Architecture

Title	Abbreviation	Calendar/Handbook
Master of Arts	MA(Hons)	Arts Military Studies
	MA	Arts Military Studies
Master of Biomedical Engineering	**MBiomedE**	**Engineering**
Master of Building	MBuild	Architecture
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 General Studies	MGenStud	General Studies
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Calendar†
Master of Health Planning	MHP	Professional Studies
Master of Landscape Architecture	MLArch	Architecture
Master of Laws by Research	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Mathematics	MMath	Sciences*
Master of Optometry	MOptom	Sciences*
Master of Physics	MPhys	Sciences*
Master of Psychology	MPsychol	Sciences‡
Master of Public Administration	MPA	AGSM
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 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**

	Title	Abbreviation	Calendar/Handbook
	Master of Surveying Science	**MSurvSc**	Engineering
	Master of Town Planning	MTP	Architecture
Graduate Diplomas	**Graduate Diploma**	**GradDip**	Applied Science Architecture **Engineering** Sciences*‡
		DipFDA	Sciences*
	Graduate Diploma in the Faculty of Professional Studies	DipArchivAdmin	Professional Studies
		DipEd	
		DipLib	

*Faculty of Science.
†Professorial Board.
‡Faculty of Biological Sciences.

Doctor of Philosophy (PhD)

1. The degree of Doctor of Philosophy may be granted by the Council on the recommendation of the Professorial Board to a candidate who has made an original and significant contribution to knowledge and who has satisfied the following requirements:

Qualifications

2. A candidate for registration for the degree of Doctor of Philosophy shall:

(1) hold an honours degree from the University of New South Wales; or

(2) hold an honours degree of equivalent standing from another approved university; or

(3) if the candidate holds a degree without honours from the University of New South Wales or other approved university, have achieved by subsequent work and study a standard recognized by the higher degree committee of the appropriate faculty or board of studies (hereinafter referred to as the committee) as equivalent to honours; or

(4) in exceptional cases, submit such other evidence of general and professional qualifications as may be approved by the Professorial Board on the recommendation of the committee.

3. When the committee is not satisfied with the qualifications submitted by a candidate, the committee may require the candidate, before being permitted to register, to undergo such examination or carry out such work as the committee may prescribe.

Registration

4. A candidate for registration for a course of study leading to the degree of Doctor of Philosophy shall apply to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

5. Subsequent to registration the candidate shall pursue a program of advanced study and research for at least six academic sessions, save that:

(1) a candidate fully engaged in advanced study and research for the degree, who before registration was engaged upon research to the satisfaction of the committee, may be exempted from not more than two academic sessions;

(2) in special circumstances the committee may grant permission for the candidate to spend not more than one calendar year of the program in advanced study and research at another institution provided that the work can be supervised in a manner satisfactory to the committee;

(3) in exceptional cases, the Professorial Board on the recommendation of the committee may grant permission for a candidate to be exempted from not more than two academic sessions.

6. A candidate who is fully engaged in research for the degree shall present for examination not later than ten academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the committee.

7. The candidate shall be fully engaged in advanced study and research, save that:

(1) the committee may permit a candidate to undertake a limited amount of University teaching or outside work which in its judgement will not interfere with the continuous pursuit of the proposed course of advanced study and research;

(2) a member of the full-time staff of the University may be accepted as a part-time candidate for the degree, in which case the committee shall prescribe a minimum period for the duration of the program;

(3) in special circumstances, the committee may, with the concurrence of the Professorial Board, accept as a part-time candidate for the degree a person who is not a member of the full-time staff of the University and is engaged in an occupation which, in its opinion, leaves the candidate substantially free to pursue a program in a school* of the University. In such a case the committee shall prescribe for the duration of the program a minimum period which, in its opinion, having regard to the proportion of the time which the candidate is able to devote to the program in the appropriate University school* is equivalent to the six sessions ordinarily required.

8. Every candidate shall pursue a program under the direction of a supervisor appointed by the committee from the full-time members of the University staff. The work, other than field work, shall be carried out in a school* of the University save that in special cases the committee may permit a candidate to conduct the work at other places where special facilities not possessed by the University may be available. Such permission will be granted only if the direction of the work remains wholly under the control of the supervisor.

9. Not later than two academic sessions after registration the candidate shall submit the topic of research for approval by the committee. After the topic has been approved it may not be changed except with the permission of the committee.

10. A candidate may be required by the committee to attend a formal course of appropriate study.

Thesis

11. On completing the course of study every candidate must submit a thesis which complies with the following requirements:

(1) the greater proportion of the work described must have been completed subsequent to registration for the PhD degree;

(2) it must be an original and significant contribution to the knowledge of the subject.

(3) it must be written in English except that a candidate in the Faculty of Arts may be required by the Faculty on the recommendation of the supervisor to write the thesis in an appropriate foreign language.

(4) it must reach a satisfactory standard of expression and presentation.

12. The thesis must present the candidate's own account of the research. In special cases work done conjointly with other persons may be accepted, provided the committee is satisfied on the candidate's part in the joint research.

13. Every candidate shall be required to submit with the thesis a short abstract of the thesis comprising not more than 600 words.

The abstract shall indicate:

(1) *the problem investigated;*

(2) *the procedures followed;*

(3) *the general results obtained;*

(4) *the major conclusions reached;*

but shall not contain any illustrative matter, such as tables, graphs or charts.

14. A candidate may not submit as the main content of the thesis any work or material which has previously been submitted for a university degree or other similar award.

*Or department where a department is not within a school.

Entry for Examination

15. The candidate shall give in writing two months' notice of intention to submit the thesis.

16. Four copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may also submit any work previously published whether or not such work is related to the thesis.

17. It shall be understood that the University retains the four copies of the thesis submitted for examination, and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

18. There shall normally be three examiners of the thesis, appointed by the Professorial Board on the recommendation of the committee, at least two of whom shall be external to the University.

19. At the conclusion of the examination each examiner shall submit to the committee a concise report on the merits of the thesis and shall recommend to the committee that:

(1) The candidate be awarded the degree without further examination; or

(2) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or

(3) the candidate be awarded the degree subject to a further examination on questions posed in the report, performance in this further examination being to the satisfaction of the committee; or

(4) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(5) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

20. If the performance at the further examination recommended under Rule **19.** (3) is not to the satisfaction of the committee the committee may permit the candidate to re-present the same thesis and submit to a further oral, practical or written examination within a period specified by them but not exceeding eighteen months.

21. The committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be admitted to the degree.

22. A candidate shall be required to pay such fees as may be determined from time to time by the Council.

Master of Biomedical Engineering (MBiomedE)

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.

Qualifications

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.

(2) In exceptional cases an applicant may be registered as a candidate for the degree if he submits 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.

*Or department where a department is not within a School.

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 two months before commencement of the session in which the candidate desires to commence.

(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 research project, the satisfactory completion of which shall be regarded as part of the examination.

(4) The progress of a candidate shall be reviewed as 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 four complete sessions from the date of registration.

Recommendation for Admission to Degree

4. 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

5. 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, or design or engineering development, which in each case is original.

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, in an appropriate school.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if he submits evidence of such academic and professional attainment as may be approved by the Professorial Board on the recommendation of the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

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

*Attention is drawn to the conditions for the award of the Degree of Master of Science, Master of Engineering or Master of Surveying without Supervision which appears elsewhere in this section.

(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 as a result of its review may 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.

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 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 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) A graduate with a pass degree of good standing from an appropriate degree course with academic standards equivalent to the Bachelor courses in Engineering or Surveying at the University of New South Wales may be admitted on the recommendation of the Head of School and the confirmation of the Committee.

(3) In special circumstances a person may be permitted to register as a candidate for the degree if he 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 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 will 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 will 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, the candidate will be required to submit a research thesis and where the formal work comprises 50% or more but less than 100% the candidate will 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 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) No full-time candidate shall be considered for the award of the degree until the lapse of two sessions from the date from which registration becomes effective. No part-time candidate shall be considered for the award of the degree until the lapse of four sessions from the date from which registration becomes effective.

Thesis/Project

4. (1) Every candidate who submits a thesis (18 or more 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 work he has published 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 as provided in paragraph **3.** (3) (b) 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.

(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.

Recommendation for Admission to Degree

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.

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 in an appropriate School or Department.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if he submits evidence of such academic and professional attainments as may be approved by the Professorial Board on the recommendation of the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

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 in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and as a result of its review may cancel registration or take such other action as it considers appropriate.

(6) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of four complete sessions from the date of registration, save that the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may be reduced by up to two sessions with the approval of the Committee. A candidate who is fully engaged in research for the degree shall present himself for examination not later than six academic sessions from the date of registration. A candidate not fully engaged in research shall present himself for examination not later than twelve academic sessions from the date of his registration. 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 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.

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 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 or engineering development which in each case is original. 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 he 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 his 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 who 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 the candidate should be admitted to the degree.

Recommendation for Admission to Degree

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Fees

Master of 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 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) A graduate with a pass degree of good standing from an appropriate degree course with academic standards equivalent to the Bachelor's courses in Engineering or Surveying at the University of New South Wales may be admitted on the recommendation of the Head of School and the confirmation of the Committee.

(3) In special circumstances a person may be permitted to register as a candidate for the degree if he submits evidence of such academic and professional attainments as may be approved by the Committee.

(4) Nothwithstanding 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 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 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.

Graduate Diploma (GradDip)

1. An application for admission to a graduate diploma course shall be made on the presribed form which should be lodged with the Registrar at least two full calendar months before the commencement of the course.

2. An applicant for admission to a graduate diploma course shall be:

(1) a graduate of the University of New South Wales or other approved university.

(2) a person with other qualifications as may be approved by Faculty.

3. Nothwithstanding 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 he desires to register. Fees shall be paid in advance.

Subject Descriptions

Identification of Subjects by Numbers

Each of the subjects taught in the University is identifiable both by number and by name. This is a fail-safe measure at the points of enrolment and examination against a student nominating a subject other than the one intended. Subject numbers are allocated by the Assistant Registrar, Examinations and Student Records, and the system of allocation is:

1. The School offering a subject is indicated by the number before the decimal point;

2. If a subject is offered by a Department within a School, the first number after the decimal point identifies that Department;

3. The position of a subject in a sequence is indicated by the third number after the decimal point. For example, 2 would indicate that the subject is the second in a sequence of subjects;

4. Graduate subjects are indicated by the suffix G.

As indicated above, a subject number is required to identify each subject in which a student is to be enrolled and for which a result is to be returned. Where students may take electives within a subject, they should desirably be enrolled initially in the particular elective, and the subject numbers allotted should clearly indicate the elective. Where it is not possible for a student to decide on an elective when enrolling or re-enrolling, and separate examinations are to be held in the electives, Schools should provide to the Examinations and Student Record Section in April (Session 1) and August (Session 2) the names of students taking each elective. Details of the actual dates in April and August are set out in the Calendar of Dates earlier in this volume.

Those subjects taught in each Faculty are listed in full in the handbook of that Faculty, together with the subject descriptions, in the section entitled **Subject Descriptions.**

Servicing Subjects are those taught by a School or Department outside its own faculty and are listed at the end of **Undergraduate Study** and **Graduate Study** of the relevant subject. Their subject descriptions are published in the handbook of the faculty in which the subject is taught.

The identifying numbers for each School are set out on the following page.

For General Studies subjects see the Board of Studies in **General Education Handbook,** which is available free of charge.

Information Key

The following is the key to the information supplied about each subject listed below: S1 (Session 1); S2 (Session 2); F (Session 1 *plus* Session 2, ie full year); S1 or S2 (Session 1 *or* Sesison 2, ie choice of either session); SS (single session, ie which session taught not known at time of publication); L (Lecture, followed by hours per week); T (Laboratory/Tutorial, followed by hours per week); C (Credit *or* Credit units).

HSC Exam Prerequisites

Subjects which require prerequisites for enrolment in terms of the HSC Examination percentile range, refer to the **1978 and subsequent HSC 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.

	School, Department etc	Faculty	Page
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2	School of Chemistry*	Science	85
3	School of Chemical Engineering*	Applied Science	86
4	School of Metallurgy*	Applied Science	86
5	**School of Mechanical and Industrial Engineering**	**Engineering**	**87**
6	**School of Electrical Engineering**	**Engineering**	**99**
7	School of Mining Engineering	Applied Science	
8	**School of Civil Engineering***	**Engineering**	**111**
9	School of Wool and Pastoral Sciences	Applied Science	
10	School of Mathematics*	Science	122
11	School of Architecture	Architecture	
12	School of Psychology	Biological Sciences	
13	School of Textile Technology	Applied Science	
14	School of Accountancy*	Commerce	124
15	School of Economics*	Commerce	124
16	School of Health Administration	Professional Studies	
17	Biological Sciences	Biological Sciences	
18	**School of Mechanical and Industrial Engineering (Industrial Engineering)**	**Engineering**	**124**
21	Department of Industrial Arts	Architecture	
22	School of Chemical Technology	Applied Science	
23	**School of Nuclear Engineering**	**Engineering**	**131**
24	**School of Transport and Highways**	**Engineering**	**133**
25	School of Applied Geology	Applied Science	
26	Department of General Studies	Board of Studies in General Education	
27	School of Geography*	Applied Science	136
28	School of Marketing	Commerce	
29	**School of Surveying**	**Engineering**	**136**
30	Department of Organizational Behaviour	Commerce	
31	School of Optometry	Science	
32	**Centre for Biomedical Engineering**	**Engineering**	**144**
35	School of Building	Architecture	
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37	School of Landscape Architecture	Architecture	
38	School of Food Technology	Applied Science	

	School, Department etc	Faculty	Page
39	Graduate School of the Built Environment	Architecture	
40	Professorial Board		
41	School of Biochemistry	Biological Sciences	
42	School of Biological Technology*	Biological Sciences	146
43	School of Botany	Biological Sciences	
44	School of Microbiology	Biological Sciences	
45	School of Zoology	Biological Sciences	
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	School of Russian	Arts	
62	School of History and Philosophy of Science	Arts	
63	School of Social Work	Professional Studies	
64	School of German	Arts	
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66	Subjects Available from Other Universities		
68	Board of Studies in Science and Mathematics	Board of Studies in Science and Mathematics	
70	School of Anatomy*	Medicine	146
71	School of Medicine	Medicine	
72	School of Pathology*	Medicine	146
73	School of Physiology and Pharmacology*	Medicine	146
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
77	School of Psychiatry	Medicine	
79	School of Community Medicine	Medicine	
80	Faculty of Medicine	Medicine	
85	Australian Graduate School of Management	AGSM	
90	Faculty of Law	Law	
97	Division of Postgraduate Extension Studies*		147

*Offers subjects for courses outlined in this handbook.

Physics

Undergraduate Study

The School of Physics has introduced the specialized units 1.951, 1.961, 1.971, 1.981, 1.962, 1.972, 1.982 and 1.992 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. However, *full-time Electrical Engineering* students may substitute 1.011 for 1.961, subject to the approval of the School of Physics.

All first year part-time students, including repeats, should enrol in 1.001.

Physics Level I Units

1.001 Physics I — F L3T3

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*21-100*
or	
4 unit Mathematics	*1-100*
or	
10.021B (for 1.001 only)	
and	
2 unit	
Science (incl. Physics and/or Chem.)	*31-100*
or	
4 unit Science (multistrand)	*31-100*

Co-requisite: 10.021C or 10.021 or 10.001 or 10.011.

Aims and nature of physics and the study of motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Concepts of force, inertia, mass, energy, momentum, charge, potential, fields. Application of the conservation principles to solution of problems involving charge, energy and momentum. Electrical circuit theory, application of Kirchoff's Laws to AC and DC circuits. Uniform circular motion. Kepler's Laws and Rotational mechanics.

A molecular approach to energy transfer, kinetic theory, gas laws and calorimetry. 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. Interaction of radiation with matter, photoelectric effect, Compton effect, spectroscopy. Resolution of the wave-particle paradox by means of wave mechanics and the uncertainty principle.

1.011 Higher Physics I — F L3T3

Prerequisite: As for 1.001. Co-requisite: 10.001 or 10.011.

For students of all Faculties except Medicine, Engineering and Architecture who have a good secondary school record and who wish to do a more challenging course. Full-time Electrical Engineering students may be admitted after consultation with the School of Physics.

As for 1.001 with additional topics: space physics, mechanical properties of real materials, rotational dynamics, physics of biological systems, AC and charged particle dynamics, physics of energy resources and conversion.

1.951 Physics I (Mechanical Engineering) — F L2T2

Prerequisites: As for 1.001 Physics I.

A basic course on physics for students in the School of Mechanical 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 I (Electrical Engineering) — F L3T3

Prerequisite: As for 1.001 Physics I.

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 I (Surveying) — F L3T3

Prerequisite: As for 1.001 Physics I.

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 I (Civil Engineering **S1 L3T2 or S2 L2T1**

Prerequisite: As for 1.001 Physics I.

Aims of physics and its relation to civil engineering. Simple harmonic motion and its relation to wave motion. Electrical and magnetic forces, Electromagnetism DC and AC circuits, bridges. Application of waves to physical optics to explain such phenomena as diffraction, interference and polarization. Holography. 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

1.962 Physics of Measurement (Surveying) **S1 L1½T1½**

Prerequisite: 1.971.

Resolution, accuracy and sensitivity of instruments. Errors of observation and their treatment. Experimental design. Displacement transducers. Transducers for other mechanical quantitites. Thermometry. Electrical noise. Dynamic response of measuring systems. Servo-systems. 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) **S2 L2T2**

Prerequisite: 1.961 or 1.001 or 1.011, 10.001. Co-requisites: 10.2111, 10.2112.

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 L2T2**

Prerequisite: 1.961 or 1.001 or 1.011, 10.001. Co-requisites: 10.2111, 10.2112.

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 Thermal Physics and Classical Mechanics (Electrical Engineering) **S1 L3T1**

Prerequisite: 1.961 or 1.001 or 1.011, 10.001. Co-requisites: 10.2111, 10.2112.

Kinetic theory, molecular velocity distribution, elementary transport theory, first law of thermodynamics; applications, microscopic aspect of thermal equilibrium, definition and properties of entropy, Boltzmann probability distribution, second law of thermodynamics, heat engine and refrigeration cycles, some thermodynamic relationships and their applications.

Relativity, motion of a particle in one, two and three dimensions including frictional force problems, damped and forced harmonic oscillator and coupled oscillators, motion of a system of particles, moving co-ordinate systems, introduction to the mechanics of continuous media.

Chemistry

Undergraduate Study

2.111 Introductory Chemistry **S1 L2T4**

Prerequisite: Nil.

Classification of matter and the language of chemistry. The gas laws and the ideal Gas Equation, gas mixtures and partial pressure. The structure of atoms, cations and anions, chemical bonding, properties of ionic and covalent compounds. The Periodic classification of elements, oxides, hydrides, halides of selected elements. Acids, bases, salts, neutralization. Stoichiometry, the mole concept. Electron transfer reaction. Qualitative treatment of reversibility and chemical equilibrium, the pH scale. Introduction to the diversity of carbon compounds.

2.121 Chemistry IA† **S1 or S2 L2T4**

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Science (any strands)	*31-100*
or	
4 unit Science (multistrand)	*31-100*
or	
2.111	

Stoichiometry and solution stoichoimetry. Structure of matter, solids, liquids, gases. Thermochemistry. Equilibria and equilibrium constants, entropy changes, free energy changes, the relationship between equilibrium and standard free energy changes. Ideal solutions, colligative properties. Equilibrium in electrolyte solutions, acid-base equilibria, solubility equilibria and redox equilibria. The rate of a chemical change and chemical kinetics.

†Students who have passed 2.121 may not subsequently enrol in 2.111. Students meeting the 2.121 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.

2.131 Chemistry IB **S1 or S2 L2T4**

Prerequisite: 2.111 or 2.121.

Relative stability of oxidation states. Electronic structure of atoms in terms of the quantum mechanical model. Structure of the Periodic Table and its relationship to electronic configuration. Chemical bonding, hydridization. Properties of compounds of selected elements, acid-base character of oxides and hydroxy compounds. Chemistry of carbon compounds, stereoisomerism, reactions of aliphatic and aromatic hydrocarbons, alcohols, phenols, ethers, alkyl halides, aldehydes, ketones, carboxylic acids and their derivatives, esters, acyl halides, anhydrides, amides, amines.

2.951 Chemistry IME **S2 L3T3**

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.

2.981 Chemistry ICE **S1 L3T3 S2 L2**

*Prerequisites:**

	HSC Exam Percentile Range Required
2 unit Science (Physics or Chem.)	*31-100*
or	
4 unit Science (multistrand)	*31-100*

Classification of matter and theories of the structure of matter. Atomic structure and the properties of compounds. Chemical change and energy concepts. Equilibrium and energy changes. Ionic equilibria. Introduction to colloidal systems.

Chemical Engineering

Undergraduate Study

3.302 Fuels and Energy **S2 L3 T1**

A servicing subject for students in Electrical Engineering which deals with sources and properties of fuels (with particular emphasis on coal, crude oil and natural gas), principles of combustion including combustion calculations and the technology of boilers and other fuel plant. A variety of alternative energy sources and review of the national and global energy situation.

Metallurgy

Undergraduate Study

4.913 Materials Science **F L2T1**

The structure and properties of crystalline substances. Crystal structures, crystal planes and directions. Examination of crystals by X-ray, electron and neutron diffraction techniques. The properties of crystalline solids. Defect structure of crystals. Influence of defects on the behaviour of crystals. The properties of metals and metallic alloys in terms of modern theories. The development of alloys for specific engineering applications. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials.

Polymer materials. The structure and properties of polymers. Mechanisms for the modification of properties.

Ceramic materials. The structure and properties of ceramics. Similarities and differences with other crystalline solids. Ceramic-metal composites.

4.941 Metallurgy for Engineers **F L1**

For students of Civil Engineering. Part of 8.259 Properties of Materials.

Solidification of metals, defects in cast metals, casting methods. Phase equilibrium in alloys. Strengthening mechanisms in metals. Elastic and plastic deformation of crystalline materials; mechanisms of slip dislocations. Fracture mechanisms, brittle fracture, fatigue and creep. Corrosion and oxidation of metals. Specification and selection of engineering alloys.

*Students may also meet the prerequisites for this subject by taking 2.111 Introductory Chemistry as part of their first year program.

Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A§ — SS L4T2

Prerequisite:

	HSC Exam Percentile Range Required
Either	
2 unit Science (Physics)	*31-100*
or	
4 unit Science (multistrand)	*11-100*
or	
2 unit Industrial Arts or	*31-100*
3 unit Industrial Arts	*11-100*

Statics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames, and beams. Simple states of stress. Statics of fluids.

Introduction to Engineering Design: Engineering method, problem identification, creative thinking, mathematical modelling, computer aided design, materials and processes, communication of ideas, the place of engineering in society.

Introduction to Materials Science: 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 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.

5.0102 Introduction to Engineering Design — SS L1T1

Engineering method, problem identification, creative thinking, mathematical modelling, computer-aided design, materials and processes, communication of ideas, the place of engineering in society.

5.020 Engineering B — SS L4T2

Prerequisite: 5.010.

Engineering Dynamics: Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy. Kinetics of systems of particles; impulse and momentum. Rotation of rigid bodies about a fixed axis. Belt, rope and chain drives, gear trains.

Mechanics of Solids I: Concepts of stress, strain. Stress and deformation due to axial force. Linear and non-linear problems, compound bars. Concepts of stiffness and flexibility. Bending moment and shear force in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

5.0201 Engineering Dynamics — SS L2T2

Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy. Kinetics of systems of particles; impulse and momentum. Rotation of rigid bodies about a fixed axis. Belt, rope and chain drives, gear trains.

5.030 Engineering C — SS L2T4 or L/T6

Engineering Drawing: Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

and, one of the following options (determined by the course of study):

1. *Design for Manufacture*
(Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option.) The implementation of design and the need for its interaction with the various manufacturing processes. Selection of materials and processes. Need for functional tolerancing. Approximately 30 hours of practical training at the Technical College workshops 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.

2. *Production Technology*
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.

3. *Introduction to Chemical Engineering*
(Chemical Engineering students must take this option.) Routes to and end uses of industrial chemicals. Likely new industrial chemicals. A survey of several Australian chemical industries from the point of view of their historical and economic importance. Examination of the unit operations involved in the industry and the raw materials, equipment and services used. Environmental aspects of the chemical industry.

4. *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.

5. *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.

§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.

6. *Introduction to Computing*
(Only available to Electrical Engineering and Surveying students who must take this option.) Introduction to computer program design with emphasis on the design of correct, reliable programs. The subject is organized on a tutorial basis and a number of simple fundamental programming tasks are illustrated. Programs are written in a high level language which provides facilities for the specifications of algorithms and data structures.

7. *Introduction to Chemical Technology*
(Industrial Chemistry students take this option.) Introduction to computation in chemical technology: process flow diagrams, infor-mation flow diagrams, flow charts in computer programming, developing of algorithms.

Principle of operation of processors. Batch and real-time processing. Concepts of steady-state and unsteady-state simulation. Programming in Fortran IV and Real-Time Basic and of programmable calculators. Concepts of on-line data acquisition and reduction. Data processing laboratory and plant data.

8. *Introduction to Ceramic Engineering*
(Ceramic Engineering students take this option.) The nature of ceramics. Classification of materials. The materials science approach. History of ceramics. The ceramic engineer and society.

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 — SS LT/3

Fundamental concepts of descriptive geometry, including reference systems, representation of point, line and place; 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 application of drawing standards. Measurements and dimensioning. Orthographic and isometric projections.

5.032 Experimental Engineering II — F L1T1

Prerequisites: 1.001 or 1.951, 5.040, 10.001. Co- or prerequisites: 5.311 or 5.330, 6.801, 5.111, 5.611.

A series of lectures, demonstrations and experiments designed to show the theory and techniques of instrumentation in Mechanical Engineering.

5.033 Experimental Engineering III — F L1T½

Prerequisites: 5.032. Co- or prerequisite: 5.071.

A series of experiments and associated lectures to illustrate some common problems in experimental work.

5.034 Engineering Experimentation — F L½T1

Prerequisites: All Year 2 full-time or Year 3 part-time subjects. Co-requisites: 5.073, 6.854.

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.

5.040 Engineering D — SS L3T5

Co- or prerequisites: 5.010, 5.030.

Mechanics of Solids I: 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.

Design for Manufacture II: Continuation of *Design for Manufacture I* with a further 30 hours of workshop training at the Technical Colleges.

5.042 Industrial Experience — LOTO

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 I — LOTO

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 II — LOTO

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 LOT6

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.

5.061 Technical Orientation — S1 L2TO

A series of lectures and visits to engineering establishments arranged to familiarize students with the profession of engineering, the industries served by engineers and current activity in engineering research. Development of skill in observing and reporting on technical matters.

5.062 Communications F L2T0

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.

5.071 Engineering Analysis F L2½T1

Prerequisite: 10.022.

Digital Computer Programming: Numerical Methods: Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations — series and stepwise methods. Solution of partial differential equations — finite difference and iterative methods. Emphasis to be placed on the use of digital computers. *Statistics:* An 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, t and F. Estimation by moments and maximum likelihood: confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction of linear regression.

5.072 Statistics/Computing S1 L1½T½ S2 L2T1

Prerequisites: 10.001 or 10.011.

Statistics: An 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, t and F. Estimation by moments and maximum likelihood: confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression.

Computing: Introduction to digital computing equipment. Flow charting. Expressions. Conditions. Input and output. Program testing. Text editing.

5.073 Numerical Analysis/ Mathematics F L2T1

Prerequisite: 10.022.

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. Variational methods: optimality conditions; functionals; Euler Lagrange equations; transversality and boundary conditions; one dimensional search; introduction to non-linear programming.

5.074 Computing Science for Mechanical Engineers S1 L2T1

Prerequisite: Computing strand of 5.072.

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.

5.111 Mechanical Engineering Design I F L1T2

Prerequisites: 5.010, 5.030, 5.040. Co- or prerequisites: 5.330, 5.611, 5.411, 8.259, 5.032.

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 currently available mechanical technology and use of standard equipment items, codes and trade literature.

5.112 Mechanical Engineering Design II F L1T2

Prerequisite: 5.111. Co- or prerequisite: 5.412.

Mathematical Modelling and Analyses, decision theory, computer programming for design applications. More advanced design analyses and drawing with individual and group project engineering experience.

5.113 Mechanical Engineering Design III F L1½T4½

Prerequisite: 5.112.

Special analytical and experimental techniques of engineering design. Optimization; reliability analysis. Major and minor design projects.

5.121 Mechanical Engineering Design I S1 L4T4 S2L3

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Science (Physics)	*31-100*
or	
4 unit Science (multistrand)	*11-100*
or	
2 unit Industrial Arts	*31-100*
or	
3 unit Industrial Arts	*11-100*

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.

5.122 Mechanical Engineering Design II F L1T2

Prerequisites: 5.010 or 5.0101, 5.121, 5.421 or 5.040 or 5.020. Co-requisite: 5.422.

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 III — 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 IV

The combination of any four subjects in the sequence 5.1241 to 5.1245.

5.1241 Creative Design Project — SS L0T3

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 — SS L1½T1½

Prerequisite: 5.123.

Aspects of mechanical engineering technology which form the basis for machinery design. Includes hydraulic power systems; circuits, pumps, motors and other equipment; welding technology; vibration control and isolation; advanced tolerancing; composite materials; fracture mechanics.

Laboratory deals with the evaluation of components for compliance with specification.

5.1243 Machinery Design Project — SS L0T3

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.

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.

5.303 Mechanical Vibrations — S1 L1T½

Prerequisites: 5.311 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: 10.002.

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.

5.330 Engineering Dynamics — F L1T1

Prerequisites: 1.001 or 1.951, 5.010 & 10.001 or 10.011.

Kinematics and kinetics of particles and rigid bodies in planar motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degrees of freedom; moment of inertia; friction; dynamic equilibrium, differential equations of motion; gyroscopic couple; work and energy, variational principles; impulse and momentum, impact.

5.331 Dynamics of Machine I — F L1½T½

Prerequisites: 5.330, 10.022.

Dynamics of Planar Mechanisms: Analytical and graphical methods for the analysis of velocities, accelerations and forces in planar mechanisms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing.

Mechanical Vibrations: Simple harmonic motion. One degree of freedom systems, free and forced vibration, transmissibility and motion isolation. Whirling of shafts.

5.332 Dynamics of Machines II — F L2T1

Prerequisite: 5.331.

Vibration of multiple degree of freedom systems. Dynamic effects in machinery. Kinematic equations of motion of spatial systems. Analysis of complex mechanisms and an introduction to the synthesis of planar mechanisms. 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: 5.330, 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 II — SS L2T1

Prerequisite: 5.343.

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 Systems Analysis — S1 L2T1

Prerequisites: 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 systems 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: determination 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 I — S1 L2T1

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 II — S2 L2T1

Noise measurement, microphones, frequency analysis, transient and average measurement. Frequency weightings. Human response annoyance and damage criteria. Flow noise, noise from jets, fans, propellers. Noise of machines, modal response, damping.

5.421 Mechanics of Solids I — S2 L2T2

Co- or prerequisites: 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 II/Materials — F L2T2½

Prerequisites: 5.010 or 5.0101, 5.421 or 5.040 or 5.020, 10.001.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Statics of frames and machines. Unsymmetrical bending. Analysis of stress; analysis of strain; generalized Hooke's Law. Thin-walled pressure vessels. Combined loads. Theories of failure. Stress concentrations and fatigue. Shear stress in beams; shear centre. Stability and buckling of columns. Solidification, Mechanical processing of metals. Phase equilibrium and its application to engineering materials. Fracture, creep, corrosion.

5.423 Mechanics of Solids III — F L1½T½

Prerequisites: 5.422 or 5.411, 10.022.

Fatigue of biaxial and triaxial systems. 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.

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 junction of ends; design of pressure vessels.

5.444 Theory of Elasticity — SS L2T1

Prerequisites: 5.423, 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; visoelasticity; 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.

5.411 Mechanics of Solids II — F L1T1

Prerequisites: 5.010, 5.040.

Statics of frames and machines. Two-dimensional stress components. Bending and shear stresses. Stresses due to combined loads. Three-dimensional stress components. Stress-strain relations. Theories of static failure. Instability of elastic columns.

5.412 Mechanics of Solids III — F L1½T½

Prerequisites: 5.411, 8.259, 10.022.

Fatigue strength, biaxial and triaxial loading. Virtual work-unit load method for deflections of beams, frames and rings; statically indeterminate structures; three-moment equation. Introduction to theory of elasticity; stress, strain, torsion. Membrane analogy. Inelastic behaviour of bars, beams, shafts and columns. Introduction to theory of plasticity. Thick curved beams; thick-walled cylinders; rotating discs.

5.413 Mechanics of Solids IV — F L2T1

Prerequisite: 5.412.

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.

5.611 Fluid Mechanics/Thermodynamics I — F L2T2

Prerequisites: 1.001 or 1.951, 5.010, 5.020, 10.001. Co- or prerequisites: 5.330, 10.002.

Dimensional systems, units, dimensional analysis, properties of substances. Statics of fluids. One-dimensional flow. Mass, energy and momentum equations. Laminar and turbulent motion. Flow in pipes. Elementary boundary layer theory. Drag. Fluid measurements. Angular momentum equation. Turbo-machines. Concepts and conservation principles of thermodynamics. First and second laws of thermodynamics. Properties of ideal gases, liquids and vapours. Non-flow and flow processes, ideal cycles. Factors limiting performance of rea cycles.

5.612 Fluid Mechanics/Thermodynamics II — F L2½T1

Prerequisites: 5.330, 5.611, 10.022.

Dimensional analysis similitude and modelling. Fields. Mass and momentum equations. Vorticity, deformation, dilatation. Existence conditions for stream and potential functions. One-dimensional gas dynamics. Nozzle flows, normal shock wave, constant area flow with friction and heat addition. Isothermal flow. Non-reactive mixtures. Refrigeration and air conditioning processes. Design considerations. Steady and unsteady state conduction heat transfer. Convective heat transfer. Radiant heat transfer. Combined modes of heat transfer.

5.614 Fluid Mechanics III — F L2T1

Prerequisite: 5.612.

Cartesian tensors. Compressible flows. Navier-Stokes and energy equations. Turbulent motion. Reynolds stresses. Boundary layer theory. Forced convection in laminar and turbulent flows. Free convection. Diffusion. Mass transfer.

5.615 Thermodynamics III — F L2T1

Prerequisite: 5.612.

General thermodynamics relations. Statistical mechanics. Quantum mechanics. Nonatomic gases and solids. Diatomic and polyatomic gases. Chemical equilibrium. Statistical mechanics of dependent particles. Real gases and solids. Irreversible processes. Radial flow and axial flow turbo-machinery. Design considerations. Cavitation. Matching of component characteristics.

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.

5.6221 Introductory Thermofluids — S1 L2T2

Work, energy, power. Units. Systems, states and processes. Flow fields; unsteady and compressible flow. Control mass and volume. Fluid properties: extensive, intensive. Equation of state. Tables of properties. First law of thermodynamics. Non flow processes: reversible, irreversible. Flow processes: energy equation, enthalpy, Bernouli's equation. Momentum equations: linear and rotational. Ideal flow.

5.6222 Fluid Mechanics — S2 L1T1

Flow measurement: orifice, nozzle, venturi meters, pitot tubes, other flow meters. Dimensional analysis: similtude, dimensionless numbers, methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent pressure loss, friction factor, losses in bends and fittings. Equations of fluid motion. Elementary boundary layer flow, skin friction and decay.

5.6223 Thermodynamics — S2 L1T1

Ideal processes and cycles, reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps, compressors, engines. Energy equation analysis, P-V diagrams.

5.623 Heat Transfer — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Conduction: steady one and two dimensional; unsteady one dimensional. Radiation: 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

Prerequisites: 5.611 or 5.622, 10.022.

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.

5.634 Viscous Flow Theory and Lubrication — SS L2T1

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. Historical review of hydrodynamic lubrication theory. Generalized Reynolds equation. Theory of plane slider and tilting pad thrust bearings. Theory of journal bearings. Gas lubricated bearings. Hydrostatic lubrication. Dynamically loaded bearings.

5.643 Thermodynamics and Combustion — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

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 (a) 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 visualisation. **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.

5.661 Mechanical Engineering III — F L2T1

Prerequisites: 1.961 or equivalent, 10.221A.

Fluids and fluid properties. The differential equations of fluid flow. Flow of nonviscous fluids. Flow of viscous fluids. Turbulence. Dimensional analysis and its applications. Turbulent flow in pipes; pipe flow problems. Boundary layers. Convection heat transfer. Laminar and turbulent flow. Heat transfer in closed conduits. Conduction and radiation. Engineering units, tables and charts. Analysis of some heat-power cycles. Steam turbines. Elementary theory of pumps and turbines. Specific speed. Design parameters. Cavitation. Scale up laws.

5.663 Potential Flow Theory — S1 L2T1

Prerequisite: 5.611 or 5.622, 10.022.

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 I — F L2T1

Prerequisites: 5.122 or 5.111, 5.330, 5.422 or 5.411. Co-requisites: 5.423 or 5.412 and 8.259.

Session 1: As for 5.123.
Session 2: Aircraft 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.

5.801 Aircraft Design II — F L2T1

Prerequisites: 5.303, 5.412 or 5.423, 5.800 (full-time only), 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 I — F L2T1

Prerequisites: 5.330, 5.611 or 5.622, 10.022.

1. Compressible flow: See Part (a) 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 II — F L2T1

Prerequisites: 5.073, 5.612 or 5.811; 5.303 or 5.331, 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 I — F L1½T½

Prerequisites: 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, tapered beams, beams with variable flange areas. Semi-monocoque structures; ribs and bulkheads. Deflection of structures; matrix (force) method. Statically indeterminate structures; beams, trusses and frames. Flexibility method; elastic centre method; moment distribution method. Aircraft materials; dimensionless stress-strain data.

5.823 Analysis of Aerospace Structure II — F L1½T½

Prerequisites: 5.412, 5.423, 5.822.

Structural instability: 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; tension field beams. Stress functions. Shear lag. Warping of thin-walled open and closed section tubes. Torsional buckling. Sandwich construction and analysis. Stresses due to torsion and shear in multicell tubes; methods of successive approximation.

5.831 Aircraft Propulsion — F L1½T½

Prerequisites: 5.611 or 5.622, Part (a) of 5.653, 5.811.

Propulsion systems: history, types, basic thrust, efficiency equations. Propellers, 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.

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.

First 10 weeks of this course are identical with the first 10 weeks of 5.123.

5.902 Ship Management Economics — S2 L1½T0

Engineering Economy portion of 18.121.

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.

5.911 Ship Hydrostatics — F L2T½

Prerequisites: 5.010 or 5.0101.

Basic concepts and integration methods. Hydrostatic particulars and approximate formulas. Intact stability, cross curves and righting arm, stability at small angles and free surface effects, the wall-sided formula, flooding and watertight subdivision. Damaged stability. Launching calculations and docking.

5.921 Ship Structures I — 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 hull 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 II — F L1½T½

Prerequisites: 5.423 or 5.412, 5.921.

Plate bending — elastic and ultimate strength analysis. Orthotropic plate bending and applications. Finite element analysis of ship structural components. Buckling and ultimate strength of columns. Buckling and ultimate strength of plates. Buckling of stiffened panels.

5.931 Principles of Ship Design IA — S1 L3T0

Mathematical modelling and decision theory, as applied to design. Introduction to FORTRAN programming.

5.932 Principles of Ship Design IIA — S2 L2T0

Co-requisite: 5.911 (5.931 full-time only).

Modern ship types and developments. The overall design process. Ship structural arrangements. Lines plan. Freeboard, tonnage, capacity. Rules of Classification Societies. Preliminary estimate of ship dimensions.

5.933 Principles of Ship Design III — 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 L0T3 S2 L0T4½

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 arrangement.

5.9311 Principles of Ship Design I — S2 L2T1

Development of ships and shipbuilding. Ship structure and lines. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard and tonnage. Ship design.

5.9321 Principles of Ship Design II — S2 L2T1

Prerequisite: 5.9311.

Theory and technique of ship design. Blocking out a ships 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. Computerised costing, modular construction, tendering, production concepts, shipyard management.

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.

5.937 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 L2½T1½

Prerequisites: 5.911, 5.951.

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 shop 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

Prerequisite: 5.330.

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 motions of a ship. Non-linear aspects. Coupled heave and pitch motion of a ship. Ocean waves and their properties.

*Design laboratory.

Graduate Study

5.045G Advanced Topic in Mechanical Engineering C2

5.046G Advanced Topic in Mechanical Engineering C2

5.047G Advanced Topic in Mechanical Engineering C2

Subjects which may be offered by a Visiting Professor for graduate credit.

5.073G Ordinary Differential Equations in Mechanical Engineering C3

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 I C2

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 II C2

Partial differential equations: finite differences and finite elements. Mathematical formulation of physical problems in mechanical engineering and their solution.

5.077G Analogue Computation in Mechanical Engineering I C2

Computing components; basic operations and mode control; programming methods; solutions of linear differential equations; system simulation; generation of functions of dependent and independent variables; approximate differentiation, roots of polynomial equations; transfer function simulation; simulation of non-linearities; scaling of linear and non-linear systems; static and dynamic check procedures; automatic iteration.

5.078G Analogue Computation in Mechanical Engineering II C2

Use of digital logic elements: gates, flip-flops, registers, counters and timers. Analog and logic interface and control facilities. Parameter optimization Run function generation. Two-speed operation.

5.086G Digital Logic Fundamentals for Mechanical Engineers C3

Discrete logic elements; assembly design; misoriented design; support devices; microprocessor units.

5.087G Microprocessor Fundamentals for Mechanical Engineers C3

Prerequisite: 5.086G, or equivalent.

Microprocessor chips; system design; memory; past design; programming; applications.

5.151G Refrigeration and Air Conditioning Design I C3

5.152G Refrigeration and Air Conditioning Design II C3

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.

5.304G Advanced Dynamics I C2

5.305G Advanced Dynamics II C2

Revision of Engineering Mechanics. Velocities and accelerations in three-dimensional co-ordinate systems. Moving frames of reference (vector equations). Eulerian angles. Ellipsoid of inertia. Lagrange's equations (various examples including applications to vibrations). Euler's equations of motion. General motion of tops and gyroscopes — stability. Lagrange's equations for impulsive forces. Hamilton's Principle.

5.315G Mechanisms I C2

5.316G Mechanisms II C2

Selected topics from: Analysis of complex planar mechanisms; synthesis of planar mechanisms; spatial linkages; cams.

5.321G Automatic Control I C2

Continuous-action controllers: controller selection and tuning; optimum settings; maximum gain method. Control system simulation. Pneumatic systems for control.

5.322G Automatic Control II C2

Analysis of non-linear control system. Describing functions and limit cycle amplitude and frequency determination. Studies of systems in which the following non-linearities dominate the behaviour: backlash,

coulomb friction, deadspace, hysteresis and saturation. Analog simultation of non-linear systems. Electronic systems for control. On-off control with and without feedback stabilization. Single-speed floating control, with and without feedback stabilization.

5.328G Control and Modelling of Mechanical Systems I C2

5.329G Control and Modelling of Mechanical Systems II C2

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. Model 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

Probability, vibration theory review, linear mechanical system response to random vibrations. Statistical characteristics: auto correlation, spatial density, convolution, narrow band processing, consistency, applications.

5.401G Experimental Stress Analysis C2

Grid technique; Moire fringe method; Strain gauges; photoelasticity; crack detection techniques. Class project.

5.415G Stress Analysis for Mechanical Engineering Design I C3

5.416G Stress Analysis for Mechanical Engineering Design II C3

Three topics in each subject selected from: Pressure vessels and enclosures. Analysis for fatigue. Plastic collapse, limit state design. Analysis of stress concentrations. Plate girder panel structures. Lightweight structures. Analysis of machine frames. High temperature components. Strength of gears. Use of computer packages in stress analysis.

5.417G Mechanics of Fracture and Fatigue C3

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.

5.428G Advanced Mechanics of Materials C2

Plasticity. Creep.

5.491G Biomechanics I C2

Statics, dynamics of the musculoskeletal system: mathematical modelling, computer simulation, analysis of walking, working and athletic activities; analysis of pathological situations.

5.492G Biomechanics II C2

The physical properties of materials having significance in biomedical engineering: human tissues, skin, soft tissues, bone; metals. *Polymers and ceramics:* the effects of degradation and corrosion.

5.615G Reciprocating Internal Combustion Engines C2

Thermodynamic cycles, fuel air mixtures, combustion, real gases. Spark ignition, detonation, combustion chamber design, modelling of emissions performance, efficiency; charging, discharging, losses. Compression ignition, knock, combustion chamber design, modelling. Alternative fuels. Emission control. Laboratory tests.

5.621G Gasdynamics I C2

5.622G Gasdynamics II C2

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 I C2

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 II C2

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 I C2

Acoustic waves, sources. Near, far fields. Vibrating surfaces. Turbulent flows. Transmission in gases, liquids, solids. Boundary reflection, refraction, transmission, scattering. Absorbing materials. Reverberant, anechoic environments, spaces, ducts. Resonators.

5.654G Acoustic Noise II C2

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.

5.712G Convection Heat Transfer I C2

5.713G Convection Heat Transfer II C2

Fluid Dynamics: boundary layer equations, solutions; transition, turbulence. Pipe flow, surface roughness. Pressure gradients. Isothermal two-phase flow. Forced convection: laminar flow; thermal boundary layers; variable fluid properties; approximate solutions; turbulent flows; high-speed flows; rarefied gases; transpiration, film cooling. Free convection: vertical surfaces, isolated bodies, horizontal surfaces, cavities, heat transfer with change of phase: condensation, evaporation; boiling, burnout; boiling in tubes; two-phase flow with phase changes. Heat exchangers; overall performance estimation.

5.718G Conduction Heat Transfer C2

Steady, one-dimensional conduction. Analysis of extended surfaces. Two- and three-dimensional conduction. Unsteady conduction in one or more dimensions; analytical, numerical and analogical methods of solution. Initial value and boundary value problems. Temperature fields with heat sources. Non-homogeneous bodies; anisotropic bodies; variable material properties.

5.719G Radiation Heat Transfer C2

Thermal radiation properties of materials, black bodies; characteristics of real solids, liquids and gases; radiation exchange between infinite surfaces and between finite surfaces; shape factor for various configurations; radiation in an enclosure; radiation behaviour of gases and vapours. Pyrometry. Solar radiation; solar angles; atmospheric absorptions of solar radiation; direct and diffuse radiation; pyrheliometers.

5.720G Performance, Evaluation and Simulation of Solar Collector Systems C2

Complete solar system analysis; long term performance prediction including weather, land characteristics. System modelling; energy storage; building characteristics; heating and cooling.

5.725G Statistical Thermodynamics C2

Mathematical probability. Classical statistical mechanics. Quantum statistics. Statistical-mechanical ensembles. Ideal monatomic gas. Fermi-Dirac statistics, Fermi-Dirac gas. Ideal Bose-Einstein gas — Black-body radiation. Ideal lattice gas. Ideal diatomic gas. Gas of symmetrical diatomic molecules at low temperatures. Ideal polyatomic gas. Chemical equilibrium in ideal gas mixtures. Lattice statistics. Imperfect gas. Approximate cell and hole theories of the liquid state. The solid phase. Irreversible processes.

5.735G Direct Energy Conversion C2

Magneto-hydrodynamics (M.H.D.): governing equations, ionisation seeding of working gas; material property limitations; fossil, nuclear fuelled M.H.D. generator combined with conventional steam plant. Fuel cells: electro chemical fundamentals; maximum work, Gibbs function, enthalpy of formation, equilibrium constant, e.m.f., limitations, polarization, existing types. Thermoelectric generators: theory of irreversible thermodynamics, Onsager coefficients, coupled phenomena, Peltier, Thomson, Seebeck effects, thermal efficiency, max. power output; deisgn of thermodynamic generator, theremoelectric cooler, magneto-theremoelectricity; radioisotope, solar powered generators; semi-conductors, basic ideas of quantum physics, Fermi level and energy bands. *Other modes of direct energy conversion:* photovoltaic; thermionic, Nernst effect generator.

5.751G Refrigeration, Air Conditioning and Cyrogenics I C2

5.752G Refrigeration, Air Conditioning and Cyrogenics II C2

Thermodynamic principles, diagrams; properties of real fluids, refrigerants. Theremodynamics 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, Jouleau, conduction, Peltier, Thomson effects; thermodynamic analysis; theremoelectric 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 Research Project C9

5.912G Naval Hydrodynamics I C2

5.913G Naval Hydrodynamics II 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 Research Thesis C18

5.936G Research Thesis C36

Electrical Engineering

Undergraduate Study

6.010 Electrical Engineering I — S1 or S2 L2T4

Prerequisite: Electricity and magnetism section of 1.961.

An orientation subject to acquaint students with the various areas and problems of Electrical Engineering. Some aspects of energy conversion and transmission; electronics; logic, number systems, and computers; systems and circuit theory; probability, information and communication. Laboratory exercises and project work in these areas include instrumentation and device characteristics.

6.021A Circuit Theory I — S1 or S2 L2T2

Prerequisite: 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 Introduction to Electromagnetic Energy Conversion — S1 or S2 L2T2

Prerequisite: 6.021A attempted.

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 a revision of three-phase circuit analysis, magnetic circuits, transformers, and basic electro-mechanical energy conversion.

6.021C Electronics I — SS L2T2

Prerequisite: 1.982, 6.021A.

A unified treatment of the fundamental principles of bipolar and field-effect transistors and their operation in simple circuits at low frequencies and room temperature in the static approximation (ie where the frequency and temperature characteristics of the device itself are neglected) . Stress on showing how to set up the transistor currents and voltages to give the circuit characteristics desired of the device (ie switching, amplification, high (or low) input impedance, etc.). An introduction to the Operational Amplifier and its uses.

6.021D Computing — S1 or S2 L2T2

Prerequisite: Computing strand of 5.030.

Programming: systematic development of algorithms and associated data-structures using PASCAL, a high-level, algorithmic, programming language which provides simple, high-level program-control and data-structure definitions facilities. The translation of a program expressed in such a high-level language to a program expressed in the more commonly encountered, lower-level, non-algorithmic programming language FORTRAN. Computer organization: simple machine architecture; data storage devices; simple operating system concepts.

6.021E Digital Logic and Systems — S1 or S2 L2T2

Prerequisite: 10.001.

A hardware oriented subject concerned with the design of digital circuits for control and general computational purposes. Includes representation of digital information, combinational logic design, clocked circuitry, digital systems and PDP 11 assembler programming.

6.022 Electrical Engineering Materials — SS L3T1

Prerequisites: 1.961 or equivalent, 2.121.

Not offered in 1980.

A survey of materials and their technology for electrical and electronic devices and systems. Influence of molecular structure on the relevant properties of metals, semiconductors, glasses, ceramics, polymers, liquids and gases, with particular regard to their electrical, magnetic, mechanical, optical and transducing characteristics and their behaviour in electrostatic,magnetic, electromagnetic and thermal fields. Thick and thin film microcircuits. Superconductivity. Control of material properties through heat-treatment, additives, etc. Composite materials, joining and bonding techniques. Failure mechanisms and long-term stability. Effects of environment; corrosion. Stabilizing and protective treatments. Example applications to illustrate selection criteria for specific purposes, including both traditional applications as well as some of contemporary interest.

6.0311 Circuit Theory II — S1 or S2 L2T2

Prerequisites: 6.021A, 10.111A, 10.1113, 10.1114, 10.2111, 10.2112, (Two of 10.1113, 10.1114, 10.2111 or 10.2112 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. Distributed circuits and transmission lines. Telegraphist's equation. Characteristic impedance and propagation constant. Terminated lines and reflection coefficient. Steady-state frequency response of lines and standing waves. Use of Smith chart. Transients and pulse reflection on lines.

6.0312 Utilization of Electric Energy — S1 L2T2

Prerequisites: 6.021A, 6.021B. Co-requisite: 6.0311.

A continuation of study of the utilization of electrical energy commenced in 6.021B. Topics treated included dc machines, three-phase and

single-phase induction machines, induction motor speed control, synchronous machines, power electronics, the thermal behaviour of equipment and the rating of plant.

6.0313 Electronics II **S1 L2T2**

Prerequisites: 6.021A, 6.021C. Co-requisite: 6.0311.

Active devices and how they may be interconnected with other cirucit elements to achieve some desired result. Includes basic transistor theory and properties, small signal, amplifier configurations, applications of negative feedback, operational amplifiers.

6.0314 Systems and Control I **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. Introduction to sampling theory and sampled data systems.

6.0315 Electrical Energy **S2 L2T2**

Prerequisite: 6.0312 attempted.

Features of the electrical supply system relevant to a user of electricity.

6.0316 Electronics III **S2 L2T2**

Prerequisite: 6.0313. Co-requisites: 6.0311, 6.021E.

Extension of 6.0313 to include tuned amplifiers, oscillators, large-signal electronics of 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 I **S2 L2T2**

Prerequisite: 6.0311. Co-requisites: 10.361.

Overview of information acquisition, transmission and processing. Aims to enable a student not specializing in this field to qualitatively understand the communication problems he is likely to meet in his career, and a general background if he intends to specialize in communications.

6.041 Electrical Measurements **SS L2T3**

Prerequisite: 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: 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), digital filtering. Information transmission capacity of signals; entropy, source coding and channel capacity. 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 **SS L2T3**

Prerequisite: 10.361.

The design and development of reliable, high-quality hard-ware, from components to systems: product and procurement specifications; factors in choice of system configuration, materials, components, processes, prediction of reliability, availablity, 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.

6.056 Mechanical Engineering **S2 L/T4**

Prerequisites: 1.961 or equivalent, 10.2111, 10.2112.

Topics: selected from 5.661 Mechanical Engineering III.

6.202 Power Engineering—Systems I **SS 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.

6.203 Power Engineering—Systems II **SS L2T3**

Prerequisite: 6.202.

A subject emphasizing interconnected system operation, performance and control; synchronous machines, power system analysis, operation and stability; distribution systems.

6.212 Power Engineering—Utilization **SS L2T3**

Prerequisites: 6.0312, 6.0315.

Topics include: Machines and electrical drives, applications and control, in particular using power reftifiers and thyristors; industrial heating; frequency changing; illumination. A program of experimental projects and design applications will accompany the lectures.

6.222 High Voltage and High Current Technology — LS L2T3

Prerequisite: 6.0315.

An elective concerned with aspects of design and testing of high power electrical equipment. Topics selected from: fields and materials in high voltage apparatus; effects of high currents; design testing and measurement; effects of transients, earthing; applications of superconductivity.

6.303 High Frequency Circuits and Electronics I — S1 L2T3

Prerequisites: 6.0311, 6.0316, 6.0317.

Fundamental aspects of high frequency and microwave circuits and electronics: TEM transmission lines, with emphasis on coaxial and microstrip lines and components. Introductory antenna theory, phased arrays and wide-band antennas. Two-port characterization, scattering parameters and noise theory, with application to high frequency bipolar and field effect transistors.

6.313 High Frequency Circuits and Electronics II — S2 L2T3

Prerequisite: 6.303.

The material extends 6.303 High Frequency Circuits and Electronics I into further areas of high frequency and microwave circuits and electronics: Plane wave propagation and application to terrestial communications. Waveguide theory and aperture antennas. Parametric amplifiers. Microwave sources, with emphasis on Gunn and impatt diodes.

6.322 Electronics IV — SS L2T3

Prerequisites: 6.0313, 6.0316.

Theory and applications of some electronic devices and systems with an associated laboratory-design program. Analogue or digital integrated circuits introduced as appropriate. Topics may include: active filters, switched transistor application, phase locked loops, optical lines, charge coupled devices, power electronics, design factors of large electronic systems.

6.323 Communication Systems IIA — S1 L2T3

Prerequisites: 6.0317, 10.033, 10.361.

Theory and practice of modern analogue and digital telecommunications techniques, including computer communications. Topics include: linear and nonlinear analogue modulation (AM, SSB, FM, etc) digital signal transmission, pulse code modulation, multiplexing (FDM and TDM), computer communication, error control, synchronization, relay systems, transmitters and receivers, aspects of transmission media relevant to telecommunications systems.

6.333 Communication Systems IIB — S2 L2T3

Prerequisites: 6.0316, 6.0317.

Theoretical and practical coverage of the major broadcast and location systems, including: radio and sound systems (AM and FM, psychoacoustics, electroacoustics), television, radar, sonar, navigation systems, and aspects of radio propagation relevant to these systems.

6.412 Systems and Control II — S1 L2T3

Prerequisites: 6.0311, 6.0314.

The design and analysis of continuous, digital and sample data feedback control systems as encountered in industrial processes, biological systems, etc. Emphasis on the synthesis of a prescribed dynamic performance via both transient and frequency domain considerations. Simulation and computer-aided design. The effects of unwanted non-linearities present in the system and the synthesis of non-linearities into the system to improve dynamic performance.

6.413 Modern Systems Engineering — S2 L2T3

Prerequisite: 6.412.

The design and analysis of control systems using system identification techniques, optimal control and multivariable control methods. The design is carried out on a simulated industrial boiler system using computer aided design programs. Other examples include: chemical plant, communication systems and biological systems.

6.432 Computer Control and Instrumentation — SS L2T3

Prerequisites: 6.021D, 6.021E, 6.0314, 6.0316.

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 discussed from both physical and dynamic response viewpoint. Digital instrumentation and displays. Hybrid devices and analog conversion. Sampling. Computer organization and interfacing concepts. Microprocessors. Peripherals. Introduction to software systems for control applications. Computer control of processes via on-line languages.

6.483 Biomedical Engineering — SS L2T3

Prerequisites: 6.0311, 6.0313, 6.0314, 6.0316.

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 the basic physiology of cells, tissues, organs and organisms, instrumentation and measurement techniques and modelling of various types of biological systems.

6.512 Advanced Semiconductor Device Theory — SS 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 — SS L2T3

Prerequisites: 6.0313, 6.0316.

Analysis of bipolar and field-effect transistor structure and operation as far as necessary for the development of accurate models for use in computer aided circuit design. Ebers Moll (EM) and Gummel-Poon transistor models. Aspects of the solution techniques used in modern CAD programs such as SPICE. Integrated circuit design including special circuit and layout considerations to take advantage of the inherent component matching. Consideration of selected circuits, for example, high-performance operational and instrumentation amplifiers, multipliers and other non-linear circuits, voltage controlled oscillators, A/D and D/A converters, etc, as class interests suggests.

6.600 Introduction to Computers — S2 L3T2

Excluded: 6.620, 6.021D, 6.601A.

For those students who do not intend taking any further computing science subjects. Introduction to programming; design and correctness of algorithms and data structures; programming in a higher level algorithmic language which provides simple high-level program control and data structuring facilities. Using computers: introduction to computing machinery, operating systems, command languages and use of computer terminals. Applications: introduction to some of the application packages that are generally available on computing systems (eg inquiry, statistics, linear programming and text formatting packages).

6.606 Computing Science Honours

6.607A Computing Hardware Architecture — S1 L3T2

Prerequisites: 6.602A, 6.602B, 6.602C, 6.602D or 6.613, 6.632, 6.642, 6.643 at an acceptable level.

The basic principles of computer architecture. A comparative study of the architectural features of a number of significant computer systems.

6.607B Advanced Software Technology — S2 L3T2

Prerequisites: 6.602A, 6.602B, 6.602C, 6.602D or 6.613, 6.632, 6.642, 6.643 at an acceptable level.

A selection of topics from a list which normally includes Artificial Intelligence, Program Verification, High Speed Calculation of Mathematical Functions, Computer Graphics.

6.612 Computer Systems Engineering — SS L2T3

Prerequisites: 6.021E or 6.602A or 6.631. Excluded: 6.613.

Analysis and design of clocked-sequential and fundamental-mode sequential circuits. Use of hardware descriptive languages for digital system design and simulation language. Applications to the description, design and simulation of basic computer circuits and organizations. Machine organization and hardware, control units, micro programming, input-output, high-speed arithmetic units.

6.613 Computer Organization and Design — SS L2T3

Prerequisites: 6.631 or 6.021E, 6.021D or 6.620. Excluded: 6.612.

Data representation, coding, register transfer and micro operations, digital technology. CPU organization: arithmetic units, control units, microprogramming, control algorithms, memory organization. Input/output organization. Hardware/software interaction. Microprocessors.

6.620 Introduction to Computing Science — S1 L3T2

Prerequisite: 10.001. Excluded: 6.600, 6.021D, 6.601A.

For those students who intend to take further subjects in computing science. 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. Introduction to computer organization: simple machine architecture. Introduction to dynamic data structures, elementary logic. Introduction to operating systems and computing machinery.

6.622 Computing Application and Software — SS L2T3

Prerequisites: 6.620 or 6.600 (C) or 6.021D.

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; the SIMULA programming language; psuedo random number generation; simple queuing theory; applications of mathematical programming; statistical calculations; critical path methods; computer graphics; artificial intelligence.

6.631 Assembler Programming and Digital Logic — S2 L3T2

Prerequisites: 6.620 or 6.600 (C) or 6.021D. Exclusions: 6.602A, 6.021E, 6.031D.

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: register transfer description of a tutorial computer, switching algebra, minimization, combinational logic design, integrated circuits, registers, counters, and other medium scale integration (m.s.i.) devices, clocked sequential circuits, computer arithmetic.

6.632 Operating Systems — S1 L3T2

Prerequisites: 6.631 or 6.021E, 6.641. Excluded: 6.602B.

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

Prerequisites: 6.632, 6.641.

Data management: compression techniques; redundancy coding; indexing; hashing; encryption and decyrption. 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.

6.641 Programming I S2 L3T2

Prerequisite: 6.620 or 6.600 (C) or 6.021D.

Design and correctness of algorithms and data structures. Data structures: abstraction, representation, manipulation and axiomatization; basic data structures: sets, unions (variant records); dynamic data structures, lists, queues, stacks, trees, balanced trees. Recursion: backtracking algorithms. Files: sequential access, random access, merging, sorting, updating. String manipulation, pattern matching and associative algorithms.

6.642 Programming II S1 L3T2

Prerequisite: 6.641.

Development and analysis of algorithms and data structures. Models of computation: uniform and logarithmic cost, decision trees. Design of efficient algorithms: divide and conquer, recurrence equations, balancing, dynamic programming. Analysis of algorithms: worst and expected case order statistics. Set manipulation problems. Key transformations (hashing). Trees: optimal, balanced, multiway. Graphs. Finite state recognition: regular expressions, pattern matching algorithms. Computability. NP-complete problems.

6.643 Compiling Techniques and Programming Languages S2 L3T2

Prerequisite: 6.641. Excluded: 6.602D.

1. Language description: phrase structure grammars, Chromsky classifications, context-free grammars, finite state grammars, Backus Naur Form, syntax graphs, LL(k), LR(k), SLR(k), LAL(k), simple-precedence and weak-precedence grammars. **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. **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

Prerequisite: 6.620 or 6.600 (C) or 6.021D. Excluded 6.602C, 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; the SIMULA programming language; pseudo random number generation; simple queueing theory; applications of mathematical programming; statistical calculations; critical path methods; computer graphics, artificial intelligence.

6.647 Business Information Systems S1 L3T2

Prerequisite: 6.641. Excluded: 14.602, 14.603, 14.604, 14.605.

Introduction to 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.

6.649 Computer Practice* S2 L3T2

Prerequisite: 6.641. Co-requisites: 6.633 or 6.643 or 6.647.

Not offered in 1980.

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. Key-board enry. Verification. Word processing; report preparation; documentation. Social implications of computing. Professional responsibilities and ethics. Project management; software engineering; psychology of computer programming.

6.801 Electrical Engineering F L1T2

Consists of 6.851 and 6.852.

6.831 Chemical Instrumentation S1 L1T2

Prerequisite: 1.001.

Not offered in 1980.

A user-oriented introduction to the electronic principles which form the basis of electronic instrumentation as used in the applied sciences. Provides a bases of circuit theory and elementary electronics and then considers analog computers, amplifier and instrumentation systems.

6.832 Industrial Electrical Machinery S2 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to the usage of electrical machinery in industry. Provides a basis of circuit-theory then considers the characteristics and selection of electrical machinery, their interface with the prime power supply, protection and electrical safety. Included in the course is a project illustrating the application of electrical engineering to other disciplines.

*Can only be counted with at least 3 other Level III Computer Science units.

6.851 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 in the course is a project illustrating the application of electrical engineering to other disciplines.

6.852 Electrical Machinery and Supply S2 L1T2

Prerequisite: 6.851.

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.

6.853 Analog and Digital Instrumentation SS L2T1

Prerequisites: 6.851 & 6.852.

Study of electrical and electronic equipment, emphasising analog and digital techniques applicable to the electrical measurement of non-electrical quantities. Open-loop and closed-loop control systems and some of their applications to instrumentation.

6.902 Industrial Experience

A minimum of three years of appropriate industrial experience must be obtained concurrently with attendance in Course 365. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

6.911 Thesis

For students in the final year of their BE degree course.

Graduate Study*

6.050G Occasional 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.

6.053G Advanced Mathematics II C3

Mathematical techniques applicable to electrical engineering problems. Topics may include: an introduction to state variable theory. Green's functions, operator theory.

6.054G Numerical Computation C3

Topics include numerical solution of partial differential equations and approximation theory.

6.060G Microprocessor Systems S1 or S2 C3

Prerequisites: 6.021D or 6.620 and 6.021E or 6.631 (or equivalent).

L.S.I. 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.

6.071G Electrical Measurements C3

Electrical measurements of moderate precision. Theory and practice of deflection measurements and null techniques at DC and low audio frequencies.

6.073G Precise Electrical Measurements C3

An advanced course primarily devoted to the special problems of precision measurements at DC and audio frequencies. Establishment of electrical standards.

6.074G Superconductivity S1 C3

The theory of superconductivity and its application. Includes loss mechanisms, ac losses, flux jumps, superconducting materials, applications to electrical apparatus.

6.075G Electric Contacts C3

The theory of stationary electric contacts making use of classical field theory and the modern ideas of electronic conduction. Topics may include constriction and film resistance, elastic and plastic deformation of contacts, thermal behaviour, electron tunnelling through thin films, tarnishing, fritting, formation of whiskers and bridges, material transfer in small contacts.

6.150G Communications Elective — Digital Signal Processing S2 C3

Fundamental principles and techniques of digital signal processing with applications in telecommunications, sonar, speech and seismology. Topics include: review of discrete-time signals and systems; discrete Fourier transform; z-transform and chirp-z transform. Digital processing of analogue signals, spectral analysis and data smoothing. Fundamentals of digital filter design techniques. Deconvolution. Errors due to quantization and finite word length. Implementation in hardware and software. Examples of applications.

*Subjects which do not have a session notation are not offered in 1980.

6.160G Field Theory in Electrical Engineering C3

Revision of metric transformations and co-ordinate systems. Solution of the Laplace and Poisson equations in the eleven Eisenhart co-ordinate systems in three dimensions. Extension to selected cases of the diffusion and wave equations.

6.161G Field Mapping C3

The Laplace and Poisson equations: complex variable techniques for 2-dimensional solutions. Graphical, experimental and numerical methods for 2- and 3-dimensional problems. The Helmholtz equation. Cases where solutions may be based on the Laplace equation. Review of selected examples in electrical engineering.

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 technqiues and implementation.

6.167G Propagation and Transmission of Electromagnetic Waves S1 C3

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.

Required as a prerequisite or co-requisite for 6.164G, 6.169G, 6.170G, 6.337G, 6.338G and 6.349G.

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.

6.224G Electrical Insulation Engineering S1 C3

Co-ordinated approach to the design of insulation systems for application at high and low voltages. Basic principles, experimental and theoretical factors involved in the establishment of particular design criteria. Practical situations and demonstrations.

6.225G Electrical Discharges and their Technical Applications S2 C3

Low and high pressure gaseous discharges, both naturally occurring and laboratory produced. Methods of production of discharges. Diagnostic techniques. Arcing in circuit interrupters and methods of control and extinction. Other technological applications of electrical discharges.

6.226G Electrical Apparatus Design C3

Based on fundamental concepts and in which thermal, electric and magnetic properties on a macroscopic scale and their inter-relationships are displayed in relation to the design of electrical and electronic apparatus.

6.227G Assessment of Insulation Performance in Electrical Plant C3

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

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. Lightning arrestors and protection for lines and substations. Power and line coupling capacitors, bus bars, connectors, cables and bushings. Line carrier systems.

6.234G Power System Protection S1 C3

The theory and application of protective devices and systems, related to the protection of transmission lines, transformers, busbars and generators.

6.244G Power Systems I C3

An advanced course dealing with topics such as economic despatch, load flow and stability in large power systems.

6.246G Power System Operation and Control S1 C3

Problems of operation and control in interconnected power systems. Objectives and priorities of system operation. Basis of operation costs. Stages in operation and operational planning — long, medium short term. Plant ordering (unit commitment). Spinning reserve. Economic dispatch. State estimation. Security monitoring. Economic secure load dispatching calculations. Reactive-power dispatching calculations, including optimization and voltage levels and transformer taps. Frequency control schemes. Voltage and VAr control. Switching and protection control of an integrated power system both manually and automatically. Emergency control, load shedding.

6.247G Power System Analysis C3

Digital computer techniques for power system analysis. Review of topics in numerical analysis: simultaneous linear and nonlinear equations, numerical integration. Eigenvectors and eigenvalues. Sparsity programming techniques and optimal equation ordering. Network equations. Load flow. Short circuit analysis. State estimation. Stability analysis: steady state and transient. Long-term dynamic simulation.

6.248G Power System Planning C3

World energy resources and alternative methods of generation and transport of energy. Sources of electrical energy on a large scale. Economic evaluation of projects. Planning the location and rating of power stations. Transmission system planning: voltage levels, fault levels, basic network interconnections. High voltage DC transmission: comparison with high voltage AC. Problems in planning distribution systems (brief treatment only). Industrial system planning. Power system reliability.

6.249G Dynamic Performance of Power Systems S2 C3

The dynamic behaviour of power systems. Modelling of power system components, simulation of their dynamic behaviour by computer program, and design of control systems for alternators in power systems.

6.250G Power Elective I C3

As for 6.050G.

6.251G Power Elective II C3

As for 6.050G.

6.254G Electrical Machines I C3

6.255G Electrical Machines II C3

These two independent options are concerned with the theory, design, operation and control of modern electrical machines.

6.256G Underground Systems C3

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

The engineering problems of 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 Communications Network 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 F 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

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.

Prerequisite or co-requisite for 6.170G and 6.345G.

6.341G Signal Analysis S1 C3

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.

Prerequisite or co-requisite for 6.337G, 6.338G, 6.343G, 6.344G, 6.345G and 6.349G. Excluded: 6.042 or similar.

6.343G Digital and Analogue Communications S1 C3

Co-requisite: 6.042 or 6.341G or similar. Excluded: 6.323 or similar.

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. Prerequisite or co-requisite for 6.347G and 6.348G.

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 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 problem for analogue and digital filters, active filters and digital filters. In addition: classical LC filters, sensitivity and parasitics, equalizer design, adaptive and/or nonlinear equalization, mechanical filters, other digital 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 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.

6.350G Solid State Electronics Elective—Reliability Engineering II S2 C3

Prerequisite: 6.044 or 6.376G.

Reliability and availability analysis by Markov states. R & A analysis for non-exponential failure and repair time distributions. Reliability

prediction by stress-strength-time models. Fault tree analysis. Failure data analysis. Component and equipment accelerated testing and screening. Failure mechanisms of electrical and mechanical hardware. Acceptance testing by variables. Statistical design. Bayesian interpretation of reliability tests. Reliability growth organisation. Cost of ownership. Warranties. Case studies.

6.373G Semiconductor Devices S1 C3

Theory and characteristics of semi-conductor 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.

6.375G Integrated Circuit Technology S2 C3

An account of the modern planar technology of semiconductor device and integrated circuit fabrication.

6.376G Reliability Engineering S1 C3

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.

6.377G Integrated Circuit Design S1 C3

An advanced course on the design of integrated circuits, including the properties and modelling of integrated circuit elements, dc and ac design of operational amplifiers, low-pass and bandpass circuits, digital gates and complex functions, computer-aided design.

6.378G 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.

6.379G Solar Cells — Operating Principles, Technology, and System Applications S2 C3

Prerequisites: 6.0313 or equivalent.

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.

6.380G Data Acquisition and Analysis in Remote Sensing S2 C3

Prerequisites: 10.361 or similar.

Techniques for extracting and analysing features in remotely sensed data, with emphasis on data acquired by the LANDSAT series. Topics are taken from the following list.

Nature and characteristics of Earth monitoring space platforms including LANDSAT, SKYLAB and the GMS weather satellites and their data acquisition methods. Sensor types and characteristics. Satellite data formats and availability. Techniques for image reconstruction, enhancement and display including: histogram transformation, grey-scale transformation, detection and characterisation of texture, edge and line detection, filtering. Techniques for feature classification including: clustering and related statistical techniques such as maximum likelihood estimation, decision tree structures, decision theoretic techniques. Techniques for detection of particular static features, such as agricultural data, geological data, water, etc. It is expected that this aspect of the syllabus would be modified by the particular interests of the participants. Procedures for handling multitemporal (time-varying) data such as found in crop discrimination, resource monitoring, large-scale fires and inland floods.

6.452G Principles of Feedback Control S1 C3

An intensive series of lectures, laboratory and tutorial, for upgrading at the graduate level those students who are deficient in the basics of control. Material covered includes design of continuous and discrete feedback systems, via classical frequency response and time-domain methods, as well as state space techniques. Nonlinear systems and systems with random inputs.

6.453G Computer Methods of Optimization S1 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 S2 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 perceptions, 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 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 S1 C3

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 S2 C3

An advanced treatment of digital, analog and hybrid computer methods, used to control physical plant in real times. Topics include: hardware techniques and software structures as encountered in industrial applications of small computers, hybrid methods for identification and optimization of systems. Students undertake individual project work, involving the planning and computer realization of specific control problems.

6.464G Applied Optimal Estimation and Prediction C3

The data handling aspects of optimal estimation and prediction. Includes: optimal linear filtering, recursive filters, Kalman filter, Riccati equation and Wiener filter; optimal smoothing; fixed-interval, fixed-point and fixed-lag; non-linear variance estimation, statistical linearization, non-linear least-squares estimation. Applications include prediction using economic models, data smoothing in seismic data processing of oil exploration and navigational problems. Development of techniques with known physical system models as well as 'black box' models.

6.466G Computer-Aided Design of Multivariable Control Systems 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 S2 C3

The fundamentals of image processing including such topics as visual perception and the image model; uniform and non-uniform sampling and quantization; image transforms; image enhancement, sharpening and smoothing; image restoration and least squares filtering; image encoding, mapping, quantizing and encoding; image segmentation and description, grammars, languages and similarity. Material oriented towards scene analysis and world models for industrial robots including scenes; labelling; shadows; shape information; structural descriptions and representing knowledge; computer vision for robots.

6.468G Computer Display Systems and Interactive Instrumentation C3

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 C3

Advanced topics taught either by visiting academics or staff members with specific research interest. Typical topics are: design case studies; current research problems and review of important papers; game theory; multi-input-output design. Stochastic control theory. Distributed systems (diffusion, display, etc). Functional analysis.

6.471G Systems and Control Elective C3

As for 6.050G Occasional Elective.

6.481G Biology and Physiology for Engineers C3

Bridging the language barrier between biology and engineering. Some problems and techniques of biology and medicine encountered by the biomedical engineer. Cells, tissues and organs, with emphasis on their system, function and characteristics.

6.484G Biological Signal Analysis S1 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.

6.485G Medical Instrumentation S2 C3

A critical survey of the theory and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories.

6.650G Computer Science Elective C3

As for 6.050G Occasional Elective.

6.651G Digital Electronics C3

Prerequisite: 6.021E and 6.0313.

Digital circuits and principles, sub-system organization, microprocessors, memory technology, interface design, integrated circuit technologies and characteristics.

6.654G Digital Systems S1 C3

Prerequisite: 6.021E.

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 S2 C3

Prerequisite: 6.546G.

Basic principles of computer architecture. A comparative study of the architectural features of a number of significant computer systems.

6.656G Software Systems A S1 C3

Prerequisite: 6.641.

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 S2 C3

Prerequisite: 6.631 and 6.641.

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 S2 C3

Prerequisites: 6.641. Excluded: 6.633.

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 Programming II S1 C3

Prerequisites: 6.641. Excluded: 6.642.

Development and analysis of algorithms and data structures. Model of computation. Set manipulation problems. Trees: optimal, balanced, multiway. Graphs. Pattern matching algorithms. Dynamic programming. Balanced merge and polyphase sorting. Heaps. NP-complete problems.

6.661G Business Information Systems S1 C3

Prerequisites: 6.641. Excluded: 6.647, 14.602, 14.603, 14.604, 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 S2 C3

Prerequisites: 6.641. Excluded 6.649. Co-requisites: 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. Key-board 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 Research Project C18

6.936G Research Project C36

Civil Engineering

Undergraduate Study

8.001 Industrial Training

Prerequisite: 8.670. Requirement for the Bachelor of Engineering Degree.

Students are required to complete a minimum of sixty working days of approved industrial training and submit a report on this training before the fourth week of Session 1.

8.002 Industrial Experience

Requirement for the Bachelor of Science (Engineering) degree.

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in the course. Students are required to submit to the School on enrolment in the final year evidence from their employers confirming completion of the prescribed period of industrial training.

8.011 Special Projects — SS L0T3

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: 8.182.

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

Prerequisite: 8.273, 8.351.

Revision of fundamentals of FORTRAN; programming and some advanced techniques such as the use of tapes, discs, and plotter. Instructions in another language such as PASCOL. Applications of finite difference and finite element methods to structural analysis, geotechnology and flow problems.

8.015 Road Engineering — S2 L2T1

Prerequisite: 8.671. Co-requisite: 8.273.

Design of roads in urban and rural areas. Properties of asphalts and bitumens. Base course materials. Pavement design. Skid resistance. Performance evaluation.

8.016 Hydraulics — SS L2T1

Prerequisite: 8.573.

Use of hydraulic models for rivers and coastal works. Further studies in open channel flow and estuarine hydraulics.

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: 8.301, 8.671.

Advanced construction 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.

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; and functions. Laplace equation, standard flow patterns; practical applications.

8.024 Foundation and Dam Engineering S1 L2T1

Prerequisite: 8.273.

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, 8.182.

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 siite as an integral part of the subject.

8.027 New Materials I SS L2T1

Prerequisite: 8.272. Co-requisites: 8.273.

History and development of polymers. Structure of polymeric 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 II SS L2T1

Prerequisite: 8.273, 8.182.

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 Law for Builders SS L2T1

Co-requisite: 8.672.

Introduction to the law, including brief outline of sources of law in New South Wales and the System of judicial precedent. General principles of law of contract. Some special forms of building contract.

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: 8.182.

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**

Introduction to FORTRAN Programming, use of WATFIV compilers, flow charts and simple problems.

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: 8.272.

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 project in the field of civil engineering materials.

8.052 Design Project — Structures

*Prerequisite: 8.191.**

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**

Practical applications 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**

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: 8.182.

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, 8.182.

Plastic analysis and design of steel members and frames. Elastic-plastic material behaviour, moment-rotation relations. Lower bound and upper bound theorems. Plastic design of 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.

*Students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject.

8.060 Numerical Methods in Geotechnology — S1 L2T1

Prerequisite: 8.273.

Introduction to finite element method; application of finite element and finite difference techniques to various soil mechanics and rock mechanics problems such as stability analysis of foundations, retaining walls, tunnel openings; prediction of settlement of footings, piles and raft foundations; seepage and consolidation analysis.

8.062 Construction Camp

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.

8.113 Civil Engineering for Electrical Engineers — S1 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 moments, 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.

8.170 Statics — SS L2T2

Equilibrium equations. Internal actions, bending moment and shear force. Simple beams and trusses.

8.171 Mechanics of Solids I — SS L1½T½

Prerequisite: 8.170.

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.

8.172 Mechanics of Solids II — SS L2T2

Prerequisite: 8.171.

Structural statics. Bending moments, shear force and torsion. Stresses due to shear force in solid and thin-walled sections; shear centre. Torsion of circular, non-circular and thin-walled sections. Principal stresses and strains; yield criteria. Combined stresses. Concepts of instability.

8.173 Structural Analysis I — 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 II — 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.

8.181 Structural Design I — F L1T1½

Prerequisite: 8.171.

Introduction to design concepts, leading to selection of appropriate structural systems. Behaviour of structural members at service loading and in the overload range up to failure. Safety. Simple beams, tension and compression members and connections in timber, concrete and steel. Proportioning of members and connections from basic principles. The objective is an understanding of structural behaviour, and the ability to produce practical and rational designs based on the elementary theory of mechanics of solids.

8.182 Structural Design II — F L1T2

Prerequisites: 8.172, 8.181.

Extension of the fundamental concepts developed in Structural Design I to the behaviour and design of more advanced members and structures. Further consideration of safety and design loads including wind and earthquake loading. Some reference to codes of practice, concentrating on the principles behind the more important sections.

Reinforced Concrete: continuous beams and frames; two-way slabs and flat slabs; footings; members subjected to combined axial force and bending moment.

Prestressed Concrete; pre- and post-tensioning; simple beams, design for working loads and ultimate flexural strength; design of end blocks.

Steel: plate girders; moment connections and splices; residual stresses; columns with elastic and restraints; plastic and elastic design of continuous beams and frames.

8.191 Structural Engineering — SS L1½T1½

Prerequisites: 8.174, 8.182*.*

1. Variational theorems applied to rigid frames; non linear analysis; dynamic analysis. Plastic analysis of steel structures. Brief treatment of finite element methods, cable structures, arches, plates and shells.

2. Timber design. Emphasis on special properties of timber affecting the design of timber structures. Introduction to plastic design of steel structures. Application to continuous beams and portal frames.

8.259 Properties of Materials — F L1T2

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. Structure and properties of binary alloys; control of structure and properties, commercial alloys, materials selection.

8.271 Introduction to Materials — SS L2T0

Types of civil engineering materials: historical development, characteristics, response to environment; material selection; traditional and new materials. Nature of materials: structure, imperfections; relationship of properties to structure; phase equilibria, iron-carbon system.

8.272 Civil Engineering Materials I — F L2T2

Co-requisite: 8.271.

Soils, crystals and types of bonds. Soil mineralogy and classification. Minerals, texture and fabric in rocks, engineering significance. Mapping and site investigations. Cements, chemistry and major constituents, hydration products. Concrete, factors affecting workability and strength, effects of curing conditions. Mechanical behaviour of materials. Response to loads, static, dynamic and impact. Effects of stress state, strain rate and temperature. Interpretation of test results. Behaviour of typical materials, non-metals, metals, elastomers, plastics and glass-reinforced composites. Timber and its properties as a structural material. Structure and properties of metals and alloys. Hot and cold working. Thermal treatments. Welding, classification of processes. Characteristics of welds and weld metal. Heat-affected zones and thermal history. Quality assurance.

8.273 Civil Engineering Materials II — F L1½T1½

Prerequisites: 8.172, 8.272.

Introduction to continuum mechanics; equilibrium equations; compatibility equations; constitutive equations; linear elasticity. Failure theories for ductile and brittle materials; fracture stress and strain; mechanisms of fracture; fatigue fracture. Basic soil properties; classification; site investigation; effective stress law; soil suction; failure and shear strength of soils and rocks; stress strain characteristics of soils and rocks; stability of soil masses; steady seepage; consolidation; stabilization; slope stability; earth and rockfill dams.

8.274 Civil Engineering Materials III — F L1½T1½

Prerequisite: 8.272. Co-requisite: 8.182.

Structural fatigue. Fracture safe design. Specification of metallic materials. Corrosion and corrosion protection. Modern steels. Structural aluminium alloys, properties, selection, applications and limitations.

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 deterioriation, permeability. Non-destructive testing.

8.301 Systems Engineering — F L1T1

Prerequisites: 10.001, 5.0102, 8.670.

The systems approach to engineering problem formulation, modelling and decision analysis is presented in a course integrating analytical theory, case studies and project work. Relevant system modelling concepts, techniques and decision models are introduced during development of a project designed to encourage the student's own creative approach.

8.351 Engineering Mathematics — SS L2½T2½

Prerequisite: 10.022.

Probability and Statistics: Introduction to probability. Random variables and standard elementary distributions. Sampling distributions. Statistical inference, hypotheses testing. Engineering applications.

Engineering Computations: Flow charts and computer programming. Error propagation. Interpolation, finite differences and regression analysis. Solution of simultaneous equations, matrix operations and eigenvalue problems. Numerical integration and solution of ordinary and partial differential equations.

8.571 Hydraulics I — SS L1½T1½

Prerequisites: 5.0201, 10.001.

Fluid properties: hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations.

8.572 Hydraulics II — 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, steady flow in uniform channels.

8.573 Hydraulics III — SS L1½T1½

Prerequisite: 8.572.

Channel flow, steady non-uniform flow, backwater curves, hydraulic jump. Flow measurement. Unsteady flow in pipes and channels. Hydraulic machinery, radial and axial flow, characteristic curves, cavitation.

*Students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject.

8.581 Water Resources I **SS L1½T1½**

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 II **SS L1½T1½**

A prior knowledge of elementary hydraulics is assumed.

The hydrologic cycle, water and energy balances, climatology, atomspheric 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 III **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.

8.670 Introduction to Engineering Construction **SS L1T0**

Introduction to construction engineering, projects and decision agents, construction equipment and methods. A report required involving site visits on a construction operation.

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 I **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 II **SS L1T2**

Prerequisite: 8.672.

Fundamentals of Engineering Economy developed within a micro-economic 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 III **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.

8.711 Engineering for Surveyors I **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.

8.712 Engineering for Surveyors II **SS L3T0**

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, sheer 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.

Servicing Subjects

8.112 Structures **S1 L1T2**

8.250 Properties of Materials **SS L2T2**

8.259 Properties of Materials **F L1T2**

Graduate Study

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; spectral analysis; other statistical methods. Decision theory.

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

Blasting techniques, tunnelling, rock-bolting and other ground support, harbours, railways, dams, bridges, structural steelwork techniques pipeline construction, foundation grouting, pile-driving, 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 costs of labour plant and materials, indirect costs 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.

8.748G Pavement Materials I 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 pavements: materials resources: in service conditions and their effect on materials performance.

8.749G Pavement Materials II 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 practic 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 I 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 II 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) I 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.

8.756G Materials of Construction (Metals and Plastics) C3

Metals: 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. Plastics: Nature, mechanical and physical properties. Use of plastics in construction.

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.

8.759G Rock Mechanics C6

Finite element analysis of rock mechanics problems. Failure theories. Creep and fracture. Influence of joints on strength and deformation of rock masses. Rock slope engineering. Tunnelling in rock.

8.760G Materials of Construction (Concrete Technology) II 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 Structural 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.

8.772G Soil Dynamics and Earthquake Analysis C3

Introduction to soil dynamics; basic principles involved in earthquake engineering; treatise of seismic waves; finite element analysis of foundations subjected to dynamic loading; analysis of dams and earth slopes due to earthquake loading; basis for design criteria. Offshore structures.

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 I 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 II 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 I C3

Review of basic aspects. Analysis of lumped mass systems with varous degrees of freedom. Vibration in beams and other continuous structures.

8.805G Vibration of Structures II C3

Vibration of buildings. Earthquake and blast loading. Bridges under moving loads. Vibration effects in foundations. Generalised dynamics and Lagrange's Equations.

8.806G Prestressed Concrete I C3

Historical development. Methods of prestressing. Elastic analysis and design. Flexural capacity and shear capacity of prestressed elements.

8.807G Prestressed Concrete II C3

Analysis and design of statically indeterminate structures. Methods of securing continuity. Composite structures.

8.808G Prestressed Concrete III C3

Analysis and design of various prestressed concrete structures. Estimating and costing. Partial prestressing.

8.809G Reinforced Concrete I 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 II 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 III 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 I C3

The perfectly plastic material; the plastic hinge; plastic collapse of beams and frames; basic theorems; general design methods.

8.813G Plastic Analysis and Design of Steel Structures II C3

Estimation of deflections; factors affecting plastic moment; shake-down; 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. Applications. Stress and strain in thin plates loaded in the plane of the plate. Applications.

8.817G Experimental Structural Analysis I 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 I **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 II **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 I **C3**

Stiffness analysis of structures. Basic of finite elements: Princple of virtual work, variational theorems, constraint equations. Effects of in-plane rigid floors and axially rigid members on the behaviour of multi-storey frames.

8.821G Structural Analysis and Finite Elements II **C3**

Variational formulation of 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 III **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. Caviation in conduits, transport of water borne 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 reflections. Effect of pumping plant behaviour.

8.833G Free Surface Flow **C3**

Theory of water flow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

8.835G Coastal Engineering I **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 II **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**

Introduction to flood estimation, design rainfall data, hydrograph analysis, storm runoff, loss rates, rational methods, 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 quality, sea water intrusion.

8.843G Groundwater Hydraulics C3

Mechanics of flow in saturated porous materials, steady and unsteady flow to wells, leaky aquifers, partial penetration, multiple aquifer boundaries, delayed yield from storage, regional studies.

8.844G 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.

8.847G 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 transformations 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 system design and analysis — capacities, corrosion, pumping.

8.853G Public Health Science C6

Not offered in 1979.

Science in public health engineering; environmental factors. Applications of chemistry, physics, biology and biochemistry to water and wastewater technology. Control of disease and industrial hygiene; community health and epidemiology. Food technology. Air pollution and solid wastes. Radioactivity and radioactive wastes.

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 I C3

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources II C3

Geophysical methods, remote sensing, photointerpretation, arid-environment studies, analog models, case studies.

8.862G 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.

8.901G Civil Engineering Elective I **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 II **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**

8.918G Research Project **C18**

Mathematics

Undergraduate Study

10.001 Mathematics I **F L4T2**

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*21-100*
or	
4 unit Mathematics	*1-100*
or	
10.021B	

Excluded: 10.011, 10.021A, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra an introduction to abstract algebra, elementary computing.

10.011 Higher Mathematics I **F L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
3 unit Mathematics	*71-100*
or	
4 unit Mathematics	*11-100*

Excluded: 10.001, 10.021A, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.022 Engineering Mathematics II **F L2T2**

Prerequisite: 10.001 or 10.011.

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).

Differential equations, use of Laplace transformations, solution 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 III **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 II — Linear Algebra **F L1½T1**

Prerequisite: 10.001 or 10.011.

Vector spaces, linear transformations and matrices, change of basis. Eigenvalues and eigenvectors, generalised eigenvectors. Functions of matrices. Linear systems of differential equations including the use of Laplace transform. Inner products, orthogonalization, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1113 Pure Mathematics II — Multivariable Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.1114 Pure Mathematics II — Complex Analysis **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011.

Analytic functions, Taylor and Laurent series, integrals Cauchy's Theorem, residues, evaluation of certain real integrals.

10.2111 Applied Mathematics II — Vector Calculus **S1 L1½T1**

Prerequisite: 10.001 or 10.011.

Vector fields; divergence, gradient curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics II — Mathematical Methods for Differential Equations **S2 L1½T1**

Prerequisites: 10.001 or 10.011.

Series solution of ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series, Bessel functions.

10.341A Statistics SU (Part A) **S1 L1½T½**

Prerequisite: 10.001 or 10.011.

An introduction to probability theory, random variables and distribution functions. Sampling distributions, including those of X^2 and t. Estimation methods, including an introduction to Least Squares and confidence interval estimation.

10.341B Statistics SU (Part B) **S2 L1½T½**

Prerequisite: 10.341A.

Further least squares and interval estimation procedures (including the user of the F distribution), with applications.

10.351 Statistics SM **F L1T½**

Prerequisite: 10.001 or 10.011.

For students in Aeronautical, Industrial and Mechanical Engineering and Naval Architecture as part of 5.071 Engineering Analysis.

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

An 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.

Graduate Study

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 and missing observations), general statistical inference (decision theory), acceptance testing, and reliability analysis (hazard functions).

Accountancy

Undergraduate Study

14.001 Introduction to Accounting A **S1 L2T0**

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 L2T0**

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.

Graduate Study

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

Undergraduate Study

15.501 Introduction to Industrial Relations **S1 or S2 L2T1½**

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.

Industrial Engineering*

Undergraduate Study

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 distributions. Experiments of comparison. Accelerated life testing. Analysis of variance. Correlation and regression.

*Industrial Engineering is a Department within the School of Mechanical and Industrial Engineering.

18.004 Manufacturing Management F L1T1

Prerequisites: 18.503, 18.603, 14.001, 14.002.

Production control: organisation, planning, modes of manufacture, information flow, demand forecasting, management systems, uncertainty. Quality control: sampling inspection, economic aspects, control charts, management of QC. Project control: critical path scheduling, PERT. Computers in manufacturing management: systems design.

18.011 Industrial Engineering IA F L1¼T¾

Prerequisite: 10.022. Co- or prerequisites: 5.071, 5.111 or 5.122.

Manufacturing Properties of Materials: Stress-strain curves to high strains, effects of strain-rate and temperature. Properties under hot and cold working. Combined stresses, yield criteria, introduction to plasticity theory. Friction effects in metal working, plane strain forging and rolling. *Metal Cutting Theory:* Mechanics of the process, effect of work-hardening, prediction of shear angle and cutting force. *Metal Cutting Tools:* Tool materials: plain carbon, alloy steel and sintered materials, hardening and heat treatment, T.T.T. curves. Tool wear, life and failure, tool performance. Surface finish. Machinability. Economics of machining. *Other Metal Removal Processes:* Electric-discharge machining, electrochemical machining.

18.012 Industrial Engineering IIA F L2T1

Prerequisites: 5.112 or 5.123, 18.011.

Theory of Manufacturing Processes: Processes including extrusion, tube making, rolling, blanking and piercing, sheet metal forming and deep drawing, oblique machining and application to practical tools. Machine tool design and utilization. Static and dynamic response of machine tools systems and effect on workpiece accuracy.

Technology of Manufacturing Processes: Selection of processes and machine tools to achieve the design requirements for a product. Functional and economic analysis of various conventional and computer-numerically-controlled (CNC) processes in relation to design. Product analysis project. Analysis of manufacturing processes and methods of assembly of selected products.

18.020 Industrial Orientation S2 L1T0

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 the Years 3 and 4.

18.021 Industrial Engineering IB F L1½T½

Prerequisite: 10.022. Co- or prerequisite: 5.071.

Engineering Economy: Price-output decisions under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their applications in the selection and replacement of processes and equipment. Construction and optimization of particular models, eg replacement, capital rationing. Measures of profitability. *Industrial Application of Probability:* Tutorial problems from the fields of sampling inspection, quality control, control charts — simple economic models, eg newsboy problem, length of steel bars.

18.022 Industrial Engineering IIB F L2T1

Prerequisites: 5.071, 18.021.

Design of Manufacturing Facilities: Product and objectives, equipment selection. Charting and systematic improvement of methods, factory and workplace layout, the factory environment. *The Use of Human and Physical Resources:* Motion and time study, financial incentives, applications to machine controlled processes. Work sampling and data collection, predetermined motion-time systems.

Industrial Psychology: Individual differences, operator selection and learning, motivation to work, conflict and frustration, social aspects of industry, worker participation.

Production Control: The detailed mechanics of control of jobbing production, and its extension to batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Application of data processing and control systems. Introduction to inventory control. Analysis of some engineering planning decisions. Sampling technques in quality control. Control charts. Further quantitative work.

18.204 Introduction to Automation I S1 or S2 L2T1

Overview of automation; comparison of mechanical, electronic and fluidic logic circuits; automation devices, eg feeders, manipulators, conveyors; introduction to digital logic and number systems as they affect automation design; systems design.

18.214 Introduction to Automation II S1 or S2 L2T1

Prerequisite: 18.204.

Introduction to the use of specific logic devices with particular reference to electronic integrated circuits; the use of microprocessors as logic devices; comparison of hardware and software logic; detailed design of simple automation systems.

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.

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.

Overview of design for production and its relation to overall design process; selection, specification and interpretation of tolerances; process selection; analysis of various production processes; jig, fixture and gauge design.

18.413 Design for Industrial Engineers S1 L1T1 S2 L1T2

Prerequisites: 5.122 or 5.123, 5.422 or 5.411 and 8.259.

Session 1: Industrial design. Tooling design. Production aids. Fluid power systems. Introduction to fatigue in design.

Session 2: (Common with Session 2 in 5.123 Mechanical Engineering Design III.) More advanced design analyses, component design and drawing with individual and group projects of an interdisciplinary nature.

18.431 Design for Production F L1T2

Prerequisite: 5.112.

General method for geometric analysis of engineering designs. Analysis for various interchangeability policies; selective assembly, unit assembly, application of probability theory. Geometry tolerancing; interpretation, datum systems, analysis, standard presentation, grouping. Economics of tolerance allocation. Process capability; relationship between process capabilities and product requirements. Principles of gauging and gauge design; production datum systems and their relation to function datum systems, effect of jig, fixture and gauge tolerances on product function. Metrology; measurement of size, form and position.

18.432 Design of Production Systems F L2T4 (Project)

Prerequisites: 5.071, 18.011, 18.021.

This subject may be taken only by part-time students in their final year.

Interchangeable Manufacture: Design for production, tooling, gauges, metrology.

Process Selection: Evaluation of alternative processes, make or buy decisions, planning the process sequence, case studies.

Production Planning: Forecasts, capacity decisions plant location, factory design and layout.

Production Systems: Computer systems for production control and information flow, computer control of machines and groups of machines, socio-technical systems.

Project: The project will consist of the design analysis for production and the planning of the production system for the manufacture of a simple engineering assembly. A comprehensive written report will be required.

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: Either 5.071 and 18.021 or 10.031, 10.331 and 18.121.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models; 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 L1T1

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: historical background. Industrial psychology, motivation, frustration and conflict. Industrial relations, union and arbitration structures. Industrial and commercial law, liability of employers, contracts, trade practices, patents. Marketing, sales forecasting, advertising ethics.

18.803 Optimization **S1 L2T1**

Prerequisite: 10.022. Co-requisite: 18.503.

Optimization in one dimension. Conditions for optimality in 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

18.121 Production Management **F L3T0**

18.131 Operations Research

Graduate Study

18.061G Industrial Experimentation I **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 of randomized block, latin square and factorial experiment designs.

18.062G Industrial Experimentation II **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.

18.073G Ergonomics **C2**

The application of ergonomics to work and industry. Applied anatomy and kinesiology leading to work place arrangements. Anthropometry and work place dimensions, seating, individual differences. Physiological and psychological aspects of work and fatigue. Environmental considerations; thermal, noise lighting. Perception, displays and machine controls. Safety considerations.

18.074G Industrial Management **C3**

Technical aspects: objectives of an enterprise or organisation,measures of overall performance, interfirm comparisons; monitoring performance, feedback and control, use of quality and inventory control, work study, accounting reports; corporate planning, use of forecasts, market surveys, operations research.

Organisational aspects: organisational structures, defining authority and responsibility; communication in organisations, information systems; the personnel function, selection, training and development, appraisal.

Human aspects: changing management styles, influences of ownership, technology, social attitudes, composition of the workforce, company size, organised labour; psychological factors, motivation, conflict situations, job satisfaction, leadership, adapting to change; industrial relations, trade unions and arbitration system structures, problems and cases; industrial democracy, participation in ownership and management.

18.080G Organization and Administration **C2**

The development of the theory and practice of organization in industry. The nature and types of organizations. The application of the principles of organization in the design of organizational structures.

18.083G Industrial Studies **C2**

Studies in the organizational and executive action requirements of certain specific industrial situations, using the case study method. Members of the class are required to make formal verbal presentation of solutions.

18.084G Industrial Applications of Probability Theory **C4**

Probability and Statistics: An introduction to probability theory. Random variables and distribution functions. The Binomial, Poisson and Normal distributions in particular. Standard sampling distributions, including X^2, t and F. Estimation by moments and maximum likelihood. Confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data. *Industrial Applications:* Tutorial problems from the fields of sampling inspection, quality control, control charts. Simple economic models — for example, the newsboy problem, length of steel bars.

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**

Brief review of N.C. systems and manual programming. Requirements of a high level language designed specifically for programming N.C. machine tools. Languages available and their use on mainframe, mini or

micro computers, eg APT, ADAPT, FANAPT, UNIAPT, MICRO APT, etc. 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.

18.262G Economics of Machining for Automation C3

Estimation of power consumption in turning, milling, contouring, etc. Economics of machining including the following cases: **1.** constant feed no constraint; **2.** machining with power and feed constraint; **3.** estimating costs to allow for variability; **4.** influence of tool and plant costs; **5.** selection of production rate to suit various criteria. Introduction to tool materials and tooling, tool materials — selection and grading, throwaway tooling, preset tooling, tool setting devices, principles of tool design.

18.271G Theory of Machine and Forming Processes C3

Plasticity Theory: Approximate methods of solution including upper bound; slip line field theory. *Manufacturing Properties of Materials:* Influence of strain, strain rate and temperature on flow stress. *Analysis of Forming Processes:* Application of theoretical methods; solutions for ideal and work hardening materials. *Analysis of Machining Processes:* Orthogonal and oblique machining theories; application to drills and mutli-point tools; prediction of cutting forces, temperature, stresses.

18.272G Technology of Machining and Forming Processes C3

Selected topics from: Machine tool vibration; designs of machine tool elements; economics of machining and forming; numerical and adaptive control of machine tools; design of dies and cutting tools for strength and wear resistance; automation.

18.370G Design of Work Systems C3

Historical review: Selection and organisation of workforces throughout history, effects of technology, use of deprived groups, characteristics and aspirations of the modern workforce. *The physical workplace:* Applications of ergonomics to workplace and handtool design. Control of the environment, safety and health considerations, lesiglation and other influences. *Planning work loads:* Estimating times for tasks, allocation of work among groups, assembly work by fixed position or by production line. Production line balancing. Group technology systems. Avoiding or allowing for fatigue. *Interaction with machines:* Machine-controlled processes, machine interference, queueing, optimisation of the man-machine system. *Interaction with others:* Co-ordination of work within groups, critical path scheduling; workplace arrangements to foster communication and avoid isolation. *Quality of work life:* Job enrichment and job enlargement. Worker participation in planning. Autonomous work groups and socio-technical systems. Trends towards industrial democracy.

18.371G Factory Design and Layout C3

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. 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 for Production C4

Influence of manufacturing processes on design; design simplication and standardization; value engineering; economics of process selection; case studies.

18.462G Industrial Design C2

Economic considerations; fundamentals of design; influence of processes; case studies.

18.463G Tool Design C4

Advanced theories and techniques for design and specification of cutting tools; jig and fixture design; press tool design, gauge design; design of selected machine tool components; computer aided tool design.

18.464G Value Analysis/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.

18.471G Design Communication C2

Communication systems in design; aids to design communication; engineering drawing practice; standardization; interpretation of design information.

18.472G Engineering Design Analysis C6

Further development of techniques for geometric analysis of engineering designs; application of probability to tolerance summations in general; economic tolerance selections. Fundamental features of jigs, fixtures and cutting tools, their design and tolerancing. Principles of gauging and application to gauge design including gauges for positional and other complex work. Case studies.

18.571G Operations Research I C6

The formulation 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 Operations Research II C6

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

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

Theories of choice, value, risk and uncertainty for the individual and for multi-person situations. Statistical decision theory. Bayes and minimax rules.

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.

18.680G Decision Making under Uncertainty C2

The structure of decisions: payoff matrices, decision trees. Principles of choice; utility of risky choice; subjective probability. Analysis of decisions under risk; certainty equivalents; value of imperfect information. Bayesian criteria of choice of their application to solving realistic problems.

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.

18.761G Simulation in Operations Research C3

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

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

Basic inventory replenishment models, continuous stock review, periodic re-ordering and base stock models, with deterministic, probabilistic, and dynamic demands. Variations of the basic models to include additional features (eg demand dependent on delivery time). Costs of the complete system in practice. Production smoothing models. Forecasting techniques. Optimum stock locations in multistage systems. Practical inventory surveys and control systems.

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

Corporate objectives and organization. The production environment. The detailed mechanics of control of jobbing production and its extension to repetition batch and continuous production. Manufacturing organization and controls, functions, inter-relationship and information flow. Relevance to computerized control. Introduction to inventory control, and the analysis of some typical engineering planning decisions.

18.862G Linear Programming C2

The revised simplex method. Sparse matrix techniques. Duality and postoptimality analysis. Extensions to the simplex method. Generalized upper bounding. Decomposition. Simplex-based nonlinear programming. Integer programming. Applications.

18.863G Nonlinear Programming C2

Single variable optimization. Search methods. Conjugate gradient and quasi-Newton methods. Methods for linear constraints. Extension to large-scale systems. Penalty function methods for nonlinear constraints. Lagrangian methods. Applications.

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.

18.871G Mathematics for Operations Research C2

Classical optimization techniques. Convexity. Kuhn-Tucker conditions. Search and gradient 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 operator theory, inequalities, stability, complex analysis, convex analysis, distribution theory, group theory and measure-theoretic probability theory.

18.877G Large-scale Optimization **C2**

Overview of large-scale problem. Identification of the master problem and subproblem. Structure of the problem: coupling variables, coupling constraints; block diagonal, block triangular matrices. Solution strategies.

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 for 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 Research Project **C18**

18.936G Research Project **C36**

18.960G Seminar (Production Engineering) **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**

18.970G Seminar (Operations Research) **C0**

18.977G Advanced Topic in Operations Research* **C2**

18.978G Advanced Topic in Operations Research* **C2**

18.979G Advanced Topic in Operations Research* **C2**

Nuclear Engineering

Undergraduate Study

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 liqid 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.

*Subjects which allow the presentation of special topics, particularly by visiting academics.

Graduate Study

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**

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**

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**

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**

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**

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**

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**

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**

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 Research Project **F C18**

23.936G Research Project **F C36**

Transport and Highways

Graduate Study

The individual subject descriptions are set out below. In a number of cases, the same word or phrase, eg parking, appears in more than one description. Where this occurs, the item should be read in the context of the subject structure, which deals with the same problem from several aspects, eg planning, design, constructions.

All subjects will normally involve three hours per week total attendance at lectures and tutorials for either one session (3 credit subjects) or for two sessions (6 credit subjects).

24.001G 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.

24.002G 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.

24.003G 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).

24.004G 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.

24.005G 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.

24.006G 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, feasibilities studies, evaluation methods. Case studies.

24.007G 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.

24.008G 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.

24.009G 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. Safty measures during maintenance.

24.010G Highway Engineering Practice Part I 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.

24.011G Highway Engineering Practice Part II 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.

24.012G Economics for Transport 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 reference 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.

24.013G Transport Economics S2 C3

Cost and price analysis of each of the transport modes (road, rail, air and sea). Welfare analysis and taxation theory with respect to transport. Economics of location; economics of land use models; regional trade model.

24.014G Transport Systems Part I 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.

24.015G Transport Systems Part II 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.

24.016G 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 improvements. Enforcement. Bus service operation.

24.017G 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.

24.018G Statistics for Transport Studies Part I 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 variables. Distribution-free inferences.

24.019G Statistics for Transport Studies Part II 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.

24.020G Mathematical Techniques for Transport Studies SS C3

Review of special techniques relevant to studies in the transport field including mathematical programming, network analysis, critical path and PERT, decision theory, queueing theory, probability theory .

24.021G Law and Administration SS C3

The law relating to the planning and construction of roads and highways and associated works, tranport law and regulations, commonwealth, state and local government responsibilities. Relevant sections of acts and ordinances.

24.022G Pavement Materials I **S1 C3**

As for 8.748G Pavement Materials I.

24.023G Pavement Materials II **S2 C3**

As for 8.749G Pavement Materials II.

24.024G Pavement Design and Evaluation I **S1 C3**

As for 8.750G Pavement Design and Evaluation I.

24.025G Pavement Design and Evaluation II **S2 C3**

As for 8.751G Pavement Design and Evaluation II.

24.026G Bridges and Highway Structures Part I **S1 C3**

Systems analysis in the choice of location and structure type of bridges, site investigation, foundation, waterways, aesthetics of design, design and planning constraints, optimum criteria, bridge structure analysis, orthotropic plate theory, articulated plate theory, theories of load distribution, matrix methods of analysis.

24.027G Bridges and Highway Structure Part II **S2 C3**

Bridge design: concrete, steel, prestressed concrete, culvert design and construction under high fills, foundation, substructure and retaining-wall design, computer programs for design and optimization.

24.028G Transport and Highway 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.

24.909G Project **F C9**

24.918G Research Project **F C18**

24.936G Research Project **F C36**

Graduate Diploma subjects

24.101G Characteristics of Transport **F C6**

Historical introduction to sea and land transport systems. Description and methods of measurement of performance characteristics of different transport modes: rail, road, sea, air, pipeline, eg capacity, speed range, unit operation costs. Operating characteristics of terminal and transfer facilities. Cargo and passenger systems, description of cargo characteristics. Inventory, insurance and packaging costs. Criteria for distribution and assignment of cargo and passenger traffic.

24.102G Fundamentals of Transport Economics **F C6**

Introductory economics and economic theory. The pricing mechanism in transport and the distinctive characteristics of transport demand and costs. Economic policy and practices in transport: road, rail, air, sea. Public enterprise economics. Costs and benefits of public investments in transport. Investment criteria. Selected special problems in the economics of transport.

24.103G Introduction to Statistics **F C6**

Introduction to probability theory. Random variables and distribution functions: binomial, normal and Poisson. Standard sampling distributions χ^2, t and F. Estimation of confidence intervals. Tests for significance based on above distributions. Introduction to linear regression and least squares adjustment of data.

24.104G Introduction to Traffic Theory **F C6**

Introduction to queueing and congestion theory. Demand and service characteristics. Maintenance and inventory theory. Scheduling and timetabling. Introduction to computer programming and simulation. Traffic patterns. Traffic flow and control: road, rail, air, sea. Traffic capacity: flow-velocity-density relationships.

24.105G Fundamentals of Transport Planning **F C6**

Generation of traffic, estimation of traffic growth and assignment of traffic to competing travelling modes. Land use and transport interaction.

24.106G Traffic Operation and Control **F C6**

Traffic measurements and data handling. Studies of capacity of roads and intersections, levels of service, delay. Accident analysis and treatments. Traffic service — street lighting and guidance. Principles of traffic design, improvements.

24.107G Soil Mechanics Applied to Road Engineering **F C8**

Soil classification and engineering significance. Sampling and in situ testing techniques in road design and construction. Compaction and stabilization in the improvement of soil characteristics. Design of embankments and cuttings. Laboratory testing of road pavement materials. Evaluation of road and airfield pavements.

24.108G Road Engineering Practice **F C8**

Bituminous pavements: Design, construction and maintenance. Standard tests for bitumens, tars and aggregates.
Highway law: The law and its application to highway engineering.

Contract documents: Types of contract and the preparation and interpretation of contract documents.
Construction planning: Critical Path and PERT applications to the planning of road construction. Introduction to the use of the computer in project planning and control.

24.109G Road Location and Design — Part I F C7

Preliminary and final survey, geometric designs of roads for rural and urban conditions, sight distances, stopping distances, passing distances, road gradients, super-elevation horizontal curves, vertical curves, appreciation of visual effects of combinations of horizontal and vertical curves, design models, types of cross section, speed change lanes, median lanes, median openings, design of at grade road junctions, expressways and parkways, types of and design of grade separation crossings. Road planning, design traffic load estimation, urban highway network planning and design road capacity and level of service. Drawing office examples in design for rural and urban conditions.

24.110G Road Location and Design — Part II F C7

Traffic engineering: Traffic measurements. Relationship between flow, concentration and stream speed. Capacity for uninterrupted and interrupted flow. Traffic signals.
Photogrammetry: Introduction to photogrammetry and simple drawing office photogrammetrical techniques.
Hydrology: Introduction to run off estimating and urban drainage.

24.111G Road Construction F C6

Specifications, bills of quantities, engineering drawings for roadworks, feasibility and cost-benefit analyses, supervision of construction, progress payments, cost estimation, construction and personnel management, report writing.

Construction planning, use of critical path methods, setting out roadworks, selection and use of roadmaking plant including fixed and mobile units, quality control.

24.112G Highway Materials F C6

Selection, evaluation and specification of materials for flexible and rigid pavements and for road embankments. Forms and origins of bituminous materials and road tars, laboratory tests, seal-coats, primes and primeseals, design of bituminous mixes, wearing courses, full depth asphalt pavements, manufacture of bituminous concrete, maintenance procedures.

Types of aggregates and their application, laboratory tests, relevance of tests to pavement performance, crushing, screening, grading of aggregates, durability of aggregates, blending procedures, quarrying and use of explosives, selection and testing of gravels.

Types of cement, additives, design of concrete mixes, transport and placing of concrete, compaction and curing, laboratory and in situ tests, quality control.

24.113G Transport and the Environment F C6

Impact of transport technology on public health and the environment. Accidents, noise, pollution, intrusion, depletion of non renewable resources; extent and measurement. Remedial measures by change, modification and improvement of technology, and by optimizing of transport activity. Role of government and community in policy formulation, implementation and monitoring.

Geography

Undergraduate Study

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.

Graduate Study

27.901G Geomorphology for Hydrologists S2 L1½T1½

Geomorphological controls in the initiation of drainage systems. Drainage networks as geomorphological systems. Types of drainage channel. River floodplains and terraces. Drainage systems of arid regions. Geomorphology of representative basics and vigil catchments. Geomorphology in the assessment of water resources. Landforms produced by underground water. Airphoto and map analysis of drainage features and map and field study of a vigil catchment.

Surveying

Undergraduate Study

Note: Electronic Calculators.

Students enrolled in the BSurv Course are required to equip themselves with an electronic calculator. Details of the features required are available from the School.

29.001 Surveying I — S1 L3T1½

Introduction to computations: principles, use of calculation aids, solution of triangles, areas of plane figures, co-ordinate systems, units of measurement. Introduction to surveying: principles, types of errors, computation of mean and standard deviation. Minor instruments: prismatic compass, clinometers, plane table alidades. Methods of distance measurement: tape measurements, corrections to tape measurements. Angular measurements: construction of theodolite, observation methods for direction and zenith distance measurement.

29.002 Surveying II — S2 L2T3

Prerequisite: 29.001.

Traversing: fieldwork, computation and adjustment. Principles of levelling, levels and associated equipment, field and reduction procedures, testing and adjustment of levels. Vertical staff tacheometry: principles, field and reduction procedures for stadia, self-reducing tacheometers. Survey methods for detail and contour surveys.

29.003 Surveying III — S1 L2½T2½

Prerequisite: 29.002.

Control surveys, orders of control, Integrated Survey Grid, methods of establishing control, practical considerations. Trigonometrical heighting, observation and reduction procedures. Barometric heighting, principles, field and reduction methods. Introduction to electronic distance measurement. Optical distance measurement. Introduction to single second theodolites.

29.004 Surveying IV — S2 L2T2½

Prerequisite: 29.002.

Setting out surveys. Calculation and setting out of horizontal circular curves and transition curves. Principles and calculation of vertical curves, sight distance. Determination of areas of irregular figures, trapezoidal and Simpson's rules. Volume determination from spot heights, contours and cross-sections, mass haul diagrams. Route surveys for roads, railways, waterways, pipe and transmission lines. Adjustments of theodolite and level.

29.005 Surveying V — S1 L3T2

Prerequisites: 29.121, 29.003.

Electronic distance measurement principles, applications and instruments, propagation of electromagnetic waves, meteorological and geometric corrections, field procedures, instrumental errors and their calibration. Calibration of linear scales. Precise angle measurement, observations and reduction procedures, sources of error and their testing.

29.006 Surveying VI* — S2 L2T1

Prerequisites: 29.005, 10.341A, 10.341B.

Error theory, expression of uncertainty, testing of observations, applications to design and analysis of surveys. Precise levelling; equipment, field procedures. Project surveys, integrated surveys, surveys for large structures, precise surveys for deformation, measurement and setting out machinery, mining and tunnel surveys, hydrographic surveys.

29.031 Electronic Distance Measurement — S2 L2T1

Prerequisites: 29.005, 29.121.

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 — S2 L2T1

Prerequisites: 29.005, 29.006.

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 — S2 L2T1

Prerequisites: 29.006.

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 — S1 L2T1

Prerequisite: 29.006.

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 — S2 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.

*Also offered in Session 1, 1980.

29.121 Electronics for Surveyors S2 L1T1

Prerequisite: 1.971.

Linear circuits and systems, active circuit elements. Test instruments and electronic measurements. Digital circuits and systems. Data transmissions, recording and display. Systems evaluation.

29.151 Survey Computations I S1 L2T2

Prerequisite: 29.002.

Calculation of areas. Calculations for subdivisions, roadways and curves. Traverse computations including offsets and missing data. Transformations. Spherical trigonometry and its application to survey problems. Resection and intersection: unique and redundant solutions. Computer programming applied to surveying.

29.152 Survey Computations II S1 L2T2

Prerequisite: 29.151.

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.

29.153 Adjustment of Control Surveys S2 L1½T1½

Prerequisites: 29.152, 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 I S1 L3

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 II S2 L0T3

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 reductions, 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.

29.173 Project S1 or S2 L0T3

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 L0T3 or S2 L0T6

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.

29.191 Survey Camp I

A one-week field camp equivalent to 42 contact hours. A series of field surveying tasks designed to consolidate the current year's work and serve as an introduction to the following year's work. Tasks include traversing, levelling, stadia and detail survey measurements for the production of a large-scale plan. Calculations, preparation of plans and reports.

29.192 Survey Camp II

Prerequisite: 29.191.

A one-week field camp equivalent to 42 contact hours. A series of field surveying tasks designed to consolidate the current year's work and serve as an introduction to the following year's work. Surveys for the design of a road alignment, determination of dam capacity and methods of point fixation. Calculations, preparation of plans and reports.

29.195 Survey Camp III

Prerequisites: 29.006, 29.192, 29.511, 29.211, 29.311, 29.152, 29.661, 29.662.

A two-week field camp equivalent to 84 contact hours. Survey projects designed to consolidate course work. Field astronomy, triangulation, trigonometric levelling, photogrammetric control and cadastral survey.

29.196 Survey Camp IV

Prerequisite: 29.195.

Two weeks of office computations equivalent to 84 contact hours. Preparation of comprehensive individual reports based on field survey tasks completed in Survey Camp III.

29.211 Geodesy I S2 L3T1

Prerequisites: 10.022, 10.341A, 10.341B, 29.151.

Historical development of geodesy. Goals of contemporary geodesy. The nature of the earth's interior. The earth's gravity field. Natural, geodetic, rectangular, and plane co-ordinates. Definition of and

computations in geodetic reference co-ordinate systems. Review of transverse cylindrical projections. Transverse Mercator projections used in Australia. Scale factor and arc-to-chord corrections on the Transverse Mercator projection.

29.212 Geodesy II — S1 L2T1

Prerequisite: 29.211.

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 III — S2 L3

Prerequisite: 29.212.

Topics from: Time variation of geodetic position. Long-term goals of geodesy. Extension of the earth's gravity field into unsurveyed regions. The earth's variable rotation. Atmospheric refraction and its effect on survey measurement. Calculations on the ellipsoid. The conformal projection of the ellipsoid.

29.231 Geophysics for Surveyors — S2 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 — S2 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 meausurements. Electromagnetic wave propagation in a turbulent medium.

29.311 Astronomy I — S2 L2T1

Prerequisites: 29.003, 29.151, 10.341A, 10.341B.

Uses of field astronomy. The solar system, the celestial sphere and the astronomical triangle. Time systems and time keeping. Latitude by circum-meridian and longitude by extra meridian methods. Prediction of observation programs. Evaluation of precision of results. Introduction to the determination of azimuth.

29.312 Astronomy II — S1 L1½T½

Prerequisite: 29.311.

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 III — S2 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.

29.441 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.

29.491 Survey Camp

A one-week field camp.

29.511 Photogrammetry I — S2 L2½T1½

Prerequisite: 29.151.

Photographic geometry, relief and tilt effects. Interior orientation. Stereoscopic vision, parallax and height. Collinearity equations and deviations from collinearity encountered in practice. Space resection. Relative orientation: concept, procedure, error effects. Ground control selection and absolute orientation. Stereoplotter principles.

29.512 Photogrammetry II — S1 L2T1

Prerequisite: 29.511.

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 III — S2 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 S1 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.

29.631 Land Inventory I S2 L1T1

Prerequisite: 27.295.

Land inventory surveys: role of surveyors, general procedures. Photo interpretation techniques, aerial photographs and their use and application. Spatial, spectral and temporal variations. Elements of interpretation. Systematic interpretation methods. Sampling methods, the purpose of sampling, sampling procedures. Elementary statistics for areal sampling. Classification systems. Reliability of mapped class boundaries. Integrated resource surveys; status of world mapping; concepts and specifications of integrated surveys. Thematic and parametric surveys.

29.632 Land Inventory II S2 L2T1

Prerequisite: 29.631.

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.

29.651 Land Development I S1 L2T1

The surveyor's role in land development. Variation of land use and land value and its effect on land development. Urbanization and land use. Location theory in urban areas. Public measures for directing land use. Social, economic and locational determinants of land use. Land on the urban fringe. Introduction to valuation. Factors affecting the value and valuation of land. Valuation principles for land use and subdivision.

29.652 Land Development II S2 L2T1

Prerequisite: 29.661.

Subdivision control in NSW. Broad-acre subdivisions under the Local Government Act, 1919. Procedures and legal controls. Review of subdivision design. Engineering aspects.

29.653 Land Development III S1 L1T2

Prerequisites: 8.712, 29.651, 29.652, 36.411.

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, 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 IV S2 L2T1

Prerequisites: 29.652, 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 management methods to staging and analysis of development projects.

29.661 Cadastral Surveying and Land Law I S1 L1½T½

The legal system in NSW as it affects the land surveyor. Forms of titles: Old System titles, Torrens titles and Crown lands titles. Land law: legislation, real and personal property, interests and estates in land, riparian rights and conveyancing. The status of roads in NSW. Maritime law. The operation of the cadastre in NSW: an historical introduction, the role of the boundary surveyor and boundary control.

29.662 Cadastral Surveying and Land Law II S1 or S2 L2T1

Prerequisite: 29.661.

Practical and legal aspects of cadastral surveying in NSW including: survey and title searching; survey investigation; re-determination of artificial and natural boundaries; related statutes, regulations and case law; the preparation of plans for title surveys; and subdivisions under the Strata Titles Act, 1973 as amended.

29.663 Cadastral Surveying and Land Law III S2 L2T1

Prerequisite: 29.662.

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 S2 L2T1

Prerequisite: 29.662.

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.

29.700 Professional Orientation **S1 L1T½**

Introduction to the total field of surveying activities and their relationship to associated disciplines. Introduction to geodesy and position fixing from celestial bodies. Map projections and co-ordinates. Introduction to the use of aerial photographs. Maps and aerial photographs and their application to resource surveys. Role of consulting surveyor. Brief introduction to cadastral, engineering and land development surveys. Mining and hydrographic surveys. Includes a visit to several surveying establishments.

29.701 Seminar I **S2 L0T1**

Basic writing and speaking, introduction to the literature of the profession. Oral presentation by individual students on assigned topics in selected areas of surveying.

29.702 Seminar II **S1 L0T1**

Prerequisite: 29.701.

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 III **S2 L½T½**

Prerequisite: 29.701.

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 I **S1 L2T0**

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 II **S2 L2T0**

Prerequisite: 29.704.

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.

29.800 Survey Draughting **S1 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.

Mapping signs and symbols recommended by the National Mapping Council. Drawing practice in boundary surveying. State regulations.

29.801 Cartography I **S2 L1½T1½**

Mathematical cartography, principles of map projections, characteristics of surveying projections and grids: Universal Transverse Mercator, Australian Map Grid, Integrated Survey Grid. Topographic cartography, representation of features, toponymy, map series, cartometry. Thematic cartography concepts. History of cartography.

29.802 Cartography II **S1 L1½T1½**

Prerequisite: 29.801.

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 **S2 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.

Servicing Subjects

29.411 Surveying for Architects and Builders **S1 L1T1½**

29.431 Surveying and Cartography **S1 L2T1½**

Graduate Study

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 optimisation and analysis of survey control networks. Methods of carrying out very large continental adjustments.

29.171G Mathematical Methods I — 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 II — 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 III — Spherical Harmonics **SS L2T1 C3**

Two dimensional Fourier Series. Theorems of vector field theory. The solution of Laplace's equation in spherical coordinates. Spherical harmonics.

29.174G Mathematical Methods IV — 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 generalised matrix algebra. Solution of large sets of equations. Confidence ellipses.

29.175G Mathematical Methods V — Collocation **SS L2T1 C3**

Fundamental assumptions. The covariance function and its modelling. The solution and theoretical accuracy. Interpolation, filtering, prediction and transformation by collocation. Applications in physical geodesy.

29.201G Geodetic Methods **SS L2T1 C3**

Basic Concepts: Motion of the earth in space. Reference coordinate systems. Geodetic boundary value problem. *Terrestrial Techniques:* Horizontal control. Vertical control. Three-dimensional control, variation with time. Polar motion and rotation. Gravity. *Space Techniques:* Worldwide and regional determination of positions. Global gravity measurements. Earth rotation, polar motion and tidal dissipation. Lunar and planetary geodesy.

29.202G Solid Earth, Ocean, Lunar and Planetary Geodesy **SS L2T1 C3**

Geodynamics: Tectonic deformation. Response of the solid earth to external effects. Gravity. Earth rotation and polar motion. *Ocean Dynamics:* Surface ocean circulation and tides. Mean sea surface. Time varying sea surface. *Moon and Planets:* Physics of the moon and planets.

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 Geodetic Analysis Techniques **SS L2T1 C3**

Orbital motion of earth's satellites, analysis of satellite orbits for low-degree harmonics of earth's gravitational field. Principles of data reduction of Doppler position systems, satellite laser ranging, long base-line interferometry and satellite altimetry.

29.206G Advanced Geodetic Instrumentation **SS L2T1 C3**

Terrestrial instrumentation: Electronic distance measuring instruments. Strainmeters. Tiltmeters. Optical-angle measurement instruments. Gravity measurements. Gravity gradiometers. Inertial navigation systems. *Ocean instrumentation:* Gravity measurements at sea. Tide gauges. Ocean pressure measurement. Bathymetry. Positioning on deep-ocean floor. *Space instrumentation:* Radio Doppler. Satellite laser ranging, global positioning system. Drag-free satellite technology, long base-line microwave interferometry. 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 specialised 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 L3T0 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. Co-ordinate measuring devices.

29.517G Stereophotogrammetry **SS L2T1 C3**

Fundamental projective 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 L3T0 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 L3T0 C3**

Prerequisite: 29.517G or consent of the instructor.

Early methods of photogrammetric control extension: radial triangulation, stereotemplets, bridging. Strip trangulation 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 L3T0 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.

29.601G Remote Sensing Principles and Procedures **S1 L2T1 and S2 L1½T1½ C6**

Electromagnetic radiation. Definition and physics of basic quantitites. 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. Computerisation of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters.

29.706G 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**

See Section on **Graduate Study** earlier in this book for details of research areas in the School.

29.918G Research Project **C18**

See section on **Graduate Study** earlier in this book for details on research areas in the School.

29.936G Research Project **C36**

See section on **Graduate Study** earlier in this book for details of research areas in the School.

Biomedical Engineering

Undergraduate Study

32.011 Biomedical Statistics **S1 L2T2 C4**

An intense, practical overview of statistics emphasising the logic of experimental design, and the use of computers to handle statistical and mass patient data. Emphasis is on statistics to assist biomedical engineers in patient diagnosis and treatment. No prior knowledge of statistics or computers assumed.

Graduate Study

32.010G Biomedical Engineering Practice **S1 L2½ 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.

32.018G Research Project **C18**

32.020G Radiation Physics **S2 L2T2 C4**

Sources, effects and uses of various types of radiation on human tissues. Ultrasonic, X-ray and nuclear radiations are included together with ultraviolet, infrared, laser, microwave and longer wavelength electromagnetic effects. Precautions in using these radiations are stressed.

32.030G Research Project **C30**

32.311G Mass Transfer in Medicine **S2 L3T1 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 Fluid Mechanics for Artificial Organs **S2 L3T1 C4**

An appreciation subject dealing with the fundamentals of fluid flow and the governing equations. Friction and viscosity, streamline and turbulent flow, flow of gases and liquids in the body and in artificial organs.

32.331G Biocompatibility **S1 L2 C2**

Interaction of biological fluids with foreign surfaces, *in vitro* tests to assess biocompatibility and thrombogenicity, hemofiltration, current status of biocompatible materials as applied to hemodialysis, membrane oxygenation and prosthetic devices.

32.500G Computing for Biomedical Engineers Using Fortran **S1 L2½T1½ C3**

Introduction to computing facilities, getting information in and out of the computer, program development, logic statements and loops, precision and accuracy subroutines and functions, debugging, matrices, declarations, program design and documentation, printer plotting, computer graphics, editing (XEDIT/MODIFY), KCL and procedure files. Overview of computers in biomedical engineering, including an introduction to aspects of automated patient monitoring and laboratory testing. Microprocessors and their capabilities. Data storage and information retrieval. Assessment of hospital computing requirements and evaluation of computer packages.

32.510G Introductory Biomechanics **S1 L2T1 C3**

Replaces 5.490G.

The principles of the mechanics of solid bodies: force systems; kinematics and kinetics of rigid bodies; stress-strain relationships; stress analysis of simple elements.

32.511G Mechanics of the Human Body **S2 L2T2 C4**

Prerequisite: 32.510G or equivalent.

Replaces 5.493G.

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

32.521G Biomechanics of Physical Rehabilitation **S1 L2T2 C4**

Prerequisite: 32.510G or equivalent.

Replaces 5.495G.

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.

32.531G Mechanical Properties of Biomaterials **S1 L2T2 C4**

Prerequisite: 32.510G or equivalent.

Replaces 5.494G.

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 L3 C3**

Refer to 6.485G.

32.612G Medical Electronics **S1 L3 C3**

Electrode systems and amplifier requirements; biotelemetry; digital systems, computers and microprocessors, and their use in medical instruments and hospital systems.

32.621G Biological Signal Analysis **S1 L3 C3**

Refer to 6.484G.

Town Planning

Undergraduate Study

36.411 Town Planning **S1 L2T0**

The urban planning process. Appearance of cities. Historical outline of cities. Levels of planning and types of plans. Ecological land use planning. Regional planning. Metropolitan planning. Neighbourhood planning. Planning law and administration. Social objectives in planning. Environmental impact assessment. Aspects of housing, new towns, the city centre, and transportation, Futuristic concepts.

Biological Technology

Graduate Study

42.211G Principles of Biology **S1 L3 C3**

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

42.212G Principles of Biochemistry **S1 L3 C3**

A condensed treatment of biochemistry comprising the following aspects: the elemental and molecular composition of living organisms; the chemistry and roles of the biological elements and molecules; the thermodynamics and enzymatic catalysis of metabolism; catabolic, anabolic, amphibolic and anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, β-oxidation and synthesis of fatty acids, deamination and decarboxylation of amino acids, the tricarboxylic acid cycle, electron transport and oxidative phosphorylation; metabolic regulation and integration.

Anatomy

Undergraduate Study

70.011C Introductory Anatomy **S1 L2T4 C6**

Introduction to gross anatomy, based on a study of prosected specimens. Musculoskeletal, cardiovascular, respiratory, gastrointestinal, genito-urinary and nervous systems. General topographical and surface anatomy. Normal variations including those related to sex and age (childhood, adolescence, maturity and senescence).

70.012A Musculoskeletal Anatomy **S1 L2T4 C6**

Prerequisites: 70.011A and 70.011B.

The topographical anatomy of the limbs and the musculoskeletal framework of the trunk. Distribution of nerves and vessels. Living and radiological anatomy.

Pathology

Undergraduate Study

72.401 Principles of Disease Processes **S1 L2 C2**

Prerequisite: 73.111 or equivalent. Pre- or co-requisite: 70.011C or equivalent.

For MBiomedE students only.

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

Undergraduate Study

73.111 Physiology 1A **F L2T4 C12**

Introduction to fundamental physiological principles — basic cellular function in terms of chemical and physical principles, and operation of the various specialized systems in the body; for example, the cardiovascular system, the respiratory system, the gastrointestinal system, the kidney, the endocrine system and the nervous system.

Division of Postgraduate Extension Studies

Graduate Study

97.001G Linguistics and Written and Spoken Communication S1 L2T1 C2

The broad purpose of the lectures on linguistics is to analyse the structure of English on the phonetic, phonemic, morphological and syntactical levels but in making this analysis, consideration is given to:

The different general approaches to linguistics: eg traditionalist, structuralist, generative and transformationalist; specific matters in theoretical dispute; eg the statistics of the phoneme; experimental and instrumental research; eg spectrographic examination of English sounds and their combination; correlations between acoustic phenomena and the perceived sounds of English; the statistics of written and spoken English. Types of communication problems; establishing identity of purpose or common ground; essential differences between written and spoken English; limitation of words; visual aids to comprehension; preparation of factual or technical reports.

97.002G Basic Information Theory F L1T2 C6

Nature and description of information. Measurement of information flow. Information content of printed, audio and video signals. Concept and measurement of redundancy. Capacity of a channel, bandwidth and power considerations. Signals in the presence of noise and crosstalk. Applications of feedback theory to communication. Entropy and mutual information. Coding. Neurological model theories. Feedback and information flow in the human nervous system. Information storage and retrieval.

97.003G Human Transformation C6

Review of transfer functions, feedback and statistical tests. Measurement of information and coding, entropy, codes and relevant coding theorems. Human information source and sink characteristics, language, Markov and Zipf, transinformation models of ear and eye. The channel, Baye's theorem, entropy and equivocation in human context. Multivariate systems in the human group context, stochastic model in the time domain.

97.004G The Psychology of Communication S1 L2T1 C3

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.

97.005G Audio and Video Equipment — Capabilities and Applications S2 L2T2 C4

Aims to give an understanding of the characteristics of equipment used in sound recording and broadcasting, television and printing with some reference to mechanical detail. Topics: audio systems; testing of audio equipment; microphones and loudspeakers; amplifiers; sound transmission; level control, recording and reproduction; studio acoustics; sound mixing; editing and effects. Television scanning; television signals; camera tubes and cameras; television receivers and picture monitors; basic concepts of colour television; the PAL colour television system; switching, mixing and processing of television signals; lighting equipment; studio floor equipment, digital signal processing equipment. Printing processes; letterpress, gravure and lithography. Photography.

97.007G Audio and Video Signals in Communication S1 L1T2 C3

Wave-theory. Propagation through media. Studio and free space acoustics. Measurement of loudness and noise. Signal fidelity.

Light in electromagnetic spectrum. Chrominance — hue and saturation. Chromaticity diagram and colour triangle. Measurement of illumination and brightness. Basic lighting design.

97.008G The Body in Communication S2 L1T2 C2

Vocal organs. Phonation. Formant patterns of speech. Acoustic specifications of speech. Mechanism and characteristics of the ear. Mechanism and characteristics of the eye. Sensation. Vision defects and illusions. The brain. Neurological signal transmission characteristics. Reflexaction. Organization of motor system.

97.010G Basic Fortran F L1 C2

Introduction to computer programming in FORTRAN IV 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; Magnetic tape and disc READ and WRITE statements; Function subprograms and subroutine programs; Sorting and merging techniques; Common Storage; Program planning and debugging.

97.012G Project S2 T5 C5

97.013G Presentation of Information S1 L1T2 C3

Communication in education. Formal education and the mass media. Production and presentation of information by audio and video displays.

97.031G Linguistics and Written and Spoken Communication C1

As for 97.001G (lectures only).

97.032G Basic Information Theory **C1**

As for 97.002G (lectures only).

97.034G Psychology of Communication **C2**

As for 97.004G (lectures only).

97.035G Audio Video Equipment **C2**

As for 97.0075 (lectures only).

97.037G Audio Video Signals in Communication **C1**

As for 9.007G (lectures only).

97.038G The Body in Communication **C1**

As for 97.008G (lectures only).

97.043G Presentation of Information **C1**

As for 97.013G (lectures only).

97.345G 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 considerations and integrated realization. Non-linear and time-variable circuits. Adaptive filters for equalization and echo cancelling. Circuit techniques for achieving reliability in integrated circuits.

Financial Assistance to Students

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. Each faculty handbook contains in its **Faculty Information** section the prizes and scholarships available within that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

As well as the assistance mentioned, there are a number of scholarships available to students. What follows is an outline only. Full information may be obtained from the Student Employment and Scholarships Unit, located on the Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar by 14 January each year. Please note that not all of these awards are available every year.

Donor	Value	Year/s of Tenure	Conditions
General			
Bursary Endowment Board*	$150 pa	Minimum period of approved degree/combined degree course	Merit in HSC and total family income not exceeding $4000.

*Apply to The Secretary, Bursary Endowment Board, Box 460, PO, North Sydney 2060 immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.
Girls' Realm Guild	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need.
Engineering			
Electrical Engineering			
The Tyree Electrical Company Pty Ltd	Up to $4000 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	
Surveying			
The Institution of Surveyors, NSW Division	Up to $250 per session	In parts 4, 5, 6 and 8 of the full-time course	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 Employment and Scholarships Unit, located on the Ground Floor of the Chancellery. This unit provides information on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

Where possible, the scholarships are listed in order of the schools within the faculty.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Research Awards	Living allowance of $4200 pa. Other allowances may also be paid.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates (or equivalent). Applications to Registrar by 31 October (30 November in special circumstances)
Commonwealth Postgraduate Research Awards		As above	Applicants must be honours graduates (or equivalent) or scholars who will graduate with honours in the current academic year, and who are domiciled in Australia.
Commonwealth Postgraduate Course Awards		1-2 years; minimum duration of course	Preference is given to applicants with employment experience. Applicants must be graduates or scholars who will graduate in the current academic year, and who have not previously held a Commonwealth Postgraduate Award. Applications to Registrar by 30 September (in special circumstances applications will be accepted until 30 November).
Australian-American Educational Foundation Travel Grant*			Applicants must be graduates, senior scholars or post-doctoral Fellows. Applications close 30 September.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women.

*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 British Council Commonwealth University Interchange Scheme	Cost of travel to UK or other Commonwealth country university		Applicants must be: **1.** University staff on study leave. Applications close with Registrar by 30 November, for visits to commence during ensuing financial year 1 April to 31 March. **2.** Graduate research workers holding research grants. Applications close with Registrar in December for visits to commence during ensuing 1 April to 31 March.
The Caltex Woman Graduate of the Year	$5000 pa for further studies in USA, UK, Northern Europe or in special cases Australia. There are no special allowances for travel or accommodation for married graduates.	2 years	Applicants must be female graduates who 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.
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	Applicants must be graduates who are Commonwealth citizens or British Protected Persons, and who are not older than 35 years of age. Applications close with Registrar by 1 October.
Sam Cracknell Memorial	Up to $3000 pa 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.
Ruth A. Cumming (ESU)	$500-$2000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia.
Gowrie Graduate Research	Maximum $2000 pa in Australia, and $2750 if tenable overseas	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War.

Graduate Scholarships (continued)

General (continued)

Donor	Value	Year/s of Tenure	Conditions
Harkness Fellowships of the Commonwealth Fund of New York*	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	Between 12 to 21 months	Candidates must be either: **1.** Members of the Australian or a State Public Service or semi-government Authority. **2.** Staff or graduate students at an Australian university. **3.** Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 30 years of age. Applications close July.
Frank Knox Memorial Fellowships at Harvard University	Stipend of $3800 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.
Nuffield Foundation Commonwealth Travelling Fellowships†	Living and travel allowances	1 year	Australian citizens usually between 25 and 35 who are graduates preferably with higher degrees and who have at least a year's teaching or research experience at a university. Applications close by February.
The Rhodes Scholarship**	Approximately £3300-£3600 stg pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens, between the ages 19 and 25 who have been domiciled in Australia at least 5 years and have completed at least 2 years of an approved university course. Applications close in July each year.
Rothmans Fellowships Award‡	$14000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applications close early September each year.

*Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, Box 3947, GPO, Sydney, NSW 2001. These must be submitted to the Registrar by 24 July.

**Applications to Mr H. McCredie, Secretary of the NSW Committee, University of Sydney, NSW 2006.

†Applications to the Secretary, The Nuffield Foundation Australian Advisory Committee, PO Box 783, Canberra City 2601.

‡Applications to The Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Engineering			
Harold G. Conde Memorial Fellowship	$4700	1 year. Renewable up to 3 years	Candidate should be honours graduate permanently domiciled in Australia. The Fellowship is for graduate study or research in a field related to the electricity industry.
University Fellowships in Highway Engineering	$4200 pa plus allowances	Course Work: 1 year Research: 1 year, renewable	The Fellowship enables scholars to complete a Master of Engineering Science Course in Highway Engineering, or alternatively undertake research leading to a Master of Engineering or PhD degree.
Kenneth W. Craig Memorial Fellowship		1 year	The Fellowship enables scholars to undertake the degree of Master of Engineering Science in the School of Nuclear Engineering.
Australian Institute of Nuclear Science and Engineering Studentships	Single students $4641 pa. Dependent spouse allowance $1632 pa, $390 for each dependent child, plus some University expenses	1-3 years	Applicants must be graduates in Nuclear Science or Engineering. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW.
Australian Institute of Nuclear Science and Engineering Research Fellowship†	$12000-$16000 pa plus certain travel and supporting grants	Minimum of 2 years. Maximum of 3 years	To enable graduates holding a PhD or similar qualification to undertake graduate work in Nuclear Science and Engineering.
Shell Scholarship in Science and Engineering	Approximately £3600 stg pa plus travelling expenses	2 years, sometimes 3	Applicants must be unmarried, male, Australian citizens, under 25 years of age, with at least 5 years domicile in Australia and who are graduates with at least 1 year's research experience. The successful candidate will undertake 2 years' graduate research leading to the MSc or PhD degree, at a British university.

†Applications to The Registrar, or AINSE Private Mail Bag, Sutherland 2232.

Prizes

Undergraduate University Prizes

The following table summarizes the undergraduate prizes awarded by the University. Prizes which are not specific to any School are listed under **General.** All other prizes are listed under the Faculty or Schools in which they are awarded.

Donor/Name of Prize	Value $	Awarded for
General		
Sydney Technical College Union Award	50.00 and medal	Leadership in the development of student affairs, and academic proficiency throughout the course.
University of New South Wales Alumni Association	Statuette	Achievement for community benefit — students in their final or graduating year.
Faculty of Engineering		
Institution of Engineers, Australia	Medal and 100.00	The most proficient final year (or last 2 years part-time) student in the Bachelor of Engineering (or Bachelor of Science (Engineering)) Degree courses offered by the following Schools: Civil Engineering Electrical Engineering Mechanical and Industrial Engineering Chemical Engineering Mining Engineering Textile Technology (Engineering option only)
The John Fraser Memorial Award	130.00	Excellence in the first year or equivalent part-time years of a bachelor's degree course offered by the Faculty of Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering		
Australian Conservation Foundation	50.00	Outstanding performance in subjects which develop environmental management concepts
Australian Welding Institute	30.00	Best design using a welding process for students in Years 2, 3 or 4
The Association of Consulting Structural Engineers of New South Wales	100.00	General proficiency — Structures in the Bachelor of Engineering degree course in Civil Engineering
	100.00	General proficiency — Structures in the Bachelor of Science (Engineering) degree course in Civil Engineering
BMI Ltd Systems Engineering	50.00	8.301 Systems Engineering
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Crawford Munro Memorial	150.00	Highest proficiency in 8.582 Water Resources II taken for the first time
Department of Civil Engineering Materials Staff	50.00	Best aggregate marks in the subjects 8.273 Civil Engineering Materials II and 8.274 Civil Engineering Materials III
Dillingham Australia Pty Ltd	100.00	Academic and professional excellence shown in the field of Construction Estimating
Harbin Polytechnical Alumni Association	50.00	Subject selected by Head of School
James Hardie Co Pty Ltd	100.00	Highest proficiency in 8.571 Hydraulics I taken for the first time
Hornibrook	100.00	Proficiency in Engineering Construction and Management

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering (continued)		
Rural Bank of NSW	50.00	Outstanding performance in 8.673 Planning and Management II
Water Board Gold Medal	Medal	Public Health Engineering
School of Electrical Engineering		
Austral Crane	25.00 25.00	Bachelor of Engineering Course in Electrical Engineering, Year III Power or Control elective
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Electricity Supply Engineers Association of New South Wales	40.00	Overall performance including proficiency in Electric Power Distribution in third year full-time or equivalent part-time course.
J. Douglas Maclurcan	30.00 book order	Control Systems
The Wilfred Holmes Memorial Award	120.00	A student eligible to enter the final year of the course and who is deemed to be in necessitous circumstances
School of Mechanical and Industrial Engineering		
Atlas Copco	75.00	General proficiency in Bachelor of Engineering course in Mechanical Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Industrial Engineering (continued)		
Austral Crane	50.00	Full-time Year III Mechanical Engineering
Babcock & Wilcox Aust Ltd	30.00	Subject selected by Head of School
Chamber of Manufacturers of New South Wales	15.00	
CSR Limited	50.00	
Ford Motor Co of Aust Ltd	25.00	
David Carment Memorial	350.00 and medal	Highest proficiency in final year of Naval Architecture course
Harbin Polytechnical Alumni Association	50.00	Subject selected by Head of School
Jeremy Hirschhorn	20.00	Theory of Machines
Royal Institution of Naval Architects	40.00	Bachelor of Engineering or Bachelor of Science (Engineering) degree course in Naval Architecture, final year or stage
Staedtler (Pacific) Pty Ltd	50.00 (order)	General proficiency in Bachelor of Engineering Course in Mechanical Engineering, Year II
Department of Industrial Engineering		
Austral Crane	50.00	Bachelor of Engineering degree course in Industrial Engineering, Year III
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Industrial Engineering (continued)		
Department of Industrial Engineering (continued)		
R. E. Jefferies Memorial	100.00	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
School of Surveying		
Board of Surveyors Medal	Medal	Bachelor of Surveying degree course, Final Year

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

School of Transport and Highways		
Veteran Motorists of Australia	20.00	Traffic Planning and Control
Wabco Aust Pty Ltd	400.00	Most distinguished graduate in Highway Engineering course leading to MEngSc degree

Faculty of Engineering

Staff

Comprises Schools of Civil Engineering, Electrical Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying, and Transport and Highways; and Centre for Biomedical Engineering.

Dean
Professor H. R. Vallentine

Chairman
Professor N. L. Svensson

Administrative Assistant
Margaret Leonard, MA *Ill.*

Professor of Civil Engineering and Head of Department of Structural Engineering
Vacant

Professor of Civil Engineering
Harold Rupert Vallentine, BE *Syd.*, MS *Iowa*, ASTC, FIEAust

Honorary Visiting Professor
James Macquarie Antill, BE *Syd.*, ME *N.S.W.*, FIEAust, FIArb, FIArbA, AMAusIMM

Honorary Associates
Lance Aubrey Endersbee, BCE ME *Melb.*, FIEAust, FASCE, MAusIMM
Desmond Ford Glynn, BCE *Melb.*, MIEAust, MASCE
Alexander Wargon, MSc *Harv.*, CE, FIEAust, FASCE, MNZIE

Senior Administrative Officer
Robert William Prior

School of Civil Engineering

Professor of Civil Engineering, Head of School and of Department of Civil Engineering Materials
Ian Kenneth Lee, BCE MEngSc PhD *Melb.*, FIEAust, MASCE

Professor of Civil Engineering and Head of Department of Engineering Construction and Management
Ronald William Woodhead, BE *Syd.*, ME *N.S.W.*, FIEAust, FAIB, MASCE, MAIC, MPMI, MACI, MIQ, MAACE

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 Professor and Acting Head of Department
Owen Graeme Ingles, BA MSc *Tas.*, CEng, CChem, FRIC, MIEAust, MInstF

Associate Professors

Somasundaram Valliappan, BE *Annam*, MS *Northeastern*, PhD *Wales*, MASCE

Geoffrey Baldwin Welch, BE *Syd.*, ME *N.S.W.*, CEng, MICE, FIEAust

Senior Lecturers

William Henry Cogill, MSc(Eng) *Cape T.*, MSc *Camb.*, PhD *N.S.W.*, FIEAust, MICE

David John Cook, BE *W.Aust.*, MSc PhD *Calg.*, MIEAust

Esca Morrice Kitchen, BE *Syd.*, MIEAust

Bruce John Francis Patten, BE *Syd.*, PhD *N.S.W.*, DIC

John Maurice Wheatley, MA PhD *Camb.*, CEng, FIM, FAusIMM, MAusIMM, MWeld(Lond), AFAIM

William Otho Yandell, ME PhD *N.S.W.*, MIEAust

Lecturers

Stephen John Hain, BE *Syd.*, PhD *N.S.W.*, MIEAust

Arthur William Manton-Hall, BE MEngSc *N.S.W.*, MIEAust

Harry Taylor, BSc(Eng) *Birm.*, DipNA&AC *Syd.*

Weeks White, BSc BE *Syd.*, MIEAust

Stephen Ross Yeomans, BSc PhD *N.S.W.*, CEng, MIM

Teaching Fellow

Angelo Cipullo, DrGeolSci *Rome*

Professional Officers

David Edwin Hattersley, MSc *N.S.W.*, ASTC

Trinh Cao, BE *Monash*

Ghodratollah Tamaddoni, BEngAg *Tehran*, DAgSc *Gembloux*

Department of Engineering Construction and Management

Includes Systems Engineering, Engineering Economy, Project Planning and Management.

Associate Professor

Alan Frank Stewart Nettleton, BSc BE *Syd.*, ME *N.S.W.*, DIC

Senior Lecturers

Arthur Gordon Douglas, ME *N.S.W.*, PhD *Mich.State*, MIEAust

Lawrence Vincent O'Neill, BE *Syd.*

Victor John Summersby, BE MEngSc *N.S.W.*, ASTC, MIEAust

Lecturers

Graham Rush Easton, BSc BE *Syd.*, MEngSc *Birm.*, MIEAust, MIArbA

Jonathan Brian O'Brien, BE *N.S.W.*, MASc *Tor.*, MIEAust

Stephen Joseph Symonds, BSc BE MTCP *Syd.*, MEngSc *N.S.W.*, MIEAust

Tutor

Michael John McMahon, BBuild MBA *N.S.W.*, AAIB

Professional Officer

Frederick Adrian John Stein, ED, BE *N.S.W.*, GradIEAust, AMASCE

Analyst Programmer

Eleanor Ruth Langley, BA *Syd.*, MACS

Department of Structural Engineering

Includes Structural Analysis, Structural Design, Stress Analysis and Solid Mechanics.

Associate Professors

Horace Joseph Brettle, BE *Syd.*, PhD *N.S.W.*, DIC, ASTC, FIEAust

Kenneth Alan Faulkes, ME *N.S.W.*, MS *Ill.*, PhD *N.S.W.*, MIEAust

Robert Alexander Frisch-Fay, DiplEng *Bud.*, ME *N.S.W.*, MIEAust

Algis Kabaila, MEngSc PhD *N.S.W.*, FRMTC, MIEAust, MASCE

B Vijaya Rangan, BE *Madr.*, PhD *I.I.S.B'lore.*, MASCE, MIEAust

Rupert Whitfield Traill-Nash, BE *W.Aust.*, PhD *Brist.*, CEng, MIEAust, MRAeC

Senior Lecturers

Peter Stephen Balint, DiplEng *Bud.*, ME *N.S.W.*, MIEAust

Donald John Fraser, MEngSc PhD *N.S.W.*, ASTC

Alex Cuthbert Heaney, BE MEngSc *Melb.*, PhD *Wat.*, MIEAust, MASCE, AMICE

Victor Andrada Pulmano, BSCE *Philippines*, MEng *A.I.T.* PhD *Northwestern*

Ian James Somervaille, BE PhD *N.S.W.*, ASTC

Lecturers

Raymond Ian Gilbert, BE *N.S.W.*, MIEAust

Peter Walder Kneen, BE *Melb.*, PhD *Wat.*, MIEAust, IASS

Raymond Eric Lawther, BE PhD *N.S.W.*

Teaching Fellows

Henry Edward Ah Cann, BE *N.S.W.*

Mario Attard, BE *N.S.W.*

Professional Officer

John Wesley Carrick, BE *N.S.W.*

Department of Water Engineering

Includes Hydraulics, Hydrology, Public Health Engineering, Water Resources Engineering, and the Water Research Laboratory.

Associate Professor and Head of Department
Bernard William Gould, BE *Tas.*, ME *N.S.W.*, MIEAust

Associate Professors
Douglas Neil Foster, BE *Syd.*, MIEAust
David Trewhella Howell, BE *Syd.*, ME *N.S.W.*, MIEAust, MAIAS
David Herbert Pilgrim, BE PhD *N.S.W.*, FIEAust
Keith Kingsford Watson, BE *Syd.*, ME PhD DSc *N.S.W.*, FIEAust

Senior Lecturers
David Barnes, BSc PhD *Birm.*, MIWSE, AMICE
Ian Cordery, ME PhD *N.S.W.*, MIEAust
Colin Raymond Dudgeon, ME *N.S.W.*, MIEAust, MASCE
Trevor Regis Fietz, ME *N.S.W.*
John Robert Learmonth, BE *Syd.*, ME *N.S.W.*
David Lyon Wilkinson, BE *Syd.*, PhD *N.S.W.*, MIEAust

Lecturers
Peter John Bliss, BE *N.S.W.*, MSc *Lond.*, DIC, ASTC, MIEAust
Brian Selby Jenkins, BE PhD *N.S.W.*, ASTC, MIEAust, LGE
David Keith Robinson, BSc BE PhD *N.S.W.*, MIEAust, MASCE

Tutor
Roger Benson Tomlinson, BE *N.S.W.*, GradIEAust

Professional Officers
David George Doran, BE DipCompSc *Qld.*, MEngSc *N.S.W.*
Kenneth Brian Higgs, MSc *Aston*, MAIP

School of Electrical Engineering

Professor of Computer Science and Head of School
Murray William Allen, BE *Adel.*, PhD *Syd.*, CEng, FIREE, MIEE, MIEEE

Professor of Electrical Engineering—Communications
Antoni Emil Karbowiak, DSc(Eng) *Lond.*, CEng, FIEAust, FTS, FIREE, SMIEE

Professor of Electrical Engineering—Systems and Control
Neville Waller Rees, BSc PhD *Wales*, FIEAust

Tyree Professor of Electrical Engineering—Electric Power Engineering
Frederic John Evans, BSc BE *Syd.*, CEng, FIEE, FIEAust

Visiting Professor—Solid State Electronics
Louis Walter Davies, AO, BSc *Syd.*, DPhil *Oxf.*, SMIEEE, FInstP, FAIP, FIREE, FTS, FAA

Professor of Electrical Engineering—Electronics
Vacant

Professor of Electrical Engineering
Rex Eugene Vowels, ME *Adel.*, SMIEEE, CEng, FIEAust, MIEE

Executive Assistant to Head of School
Colin Arthur Stapleton, BSc BE *Syd.*, CEng, MIEAust, MIEE, MIEEE

Senior Administrative Officer
Halsey George Phillips

Administrative Assistant
Robyn Christine Horwood, BA DipEd *N.S.W.*

Senior Tutor
Geoffrey Nicholas Horton Westley, BEng *Liv.*, MIEEE

Tutors
David Athol Carrington, BSc *N.S.W.*
Peter William Cook, BE *James Cook*
Douglas James Follett, BE *N.S.W.*
Ria Maren Follett, BSc *Syd.*
Peter Garde, BE MEngSc *Monash*
Kevin Frank Hill, BE *N.S.W.*
Gregory Charles Hurst, BSc BE *N.S.W.*
Fuad Assia Jilwan, BE *N.S.W.*

Professional Officer
Jeffrey Stanley Skebe, BS *Case W.R.*

Department of Communications

Associate Professors

Warwick Harvey Holmes, BSc BE MEngSc *Syd.*, PhD *Camb.*, SMIEEE, MIREE

The Bao Vu, BE PhD *Adel.*, SMIEEE

Senior Lecturers

Pak Lim Chu, ME PhD *N.S.W.*, MIREE

Edward Henry Fooks, BSc PhD *Lond.*, CEng, MIEE, MIEEE

Thomas Leslie Hooper, BSc *Syd.*, MSc *N.S.W.*, CEng, MIEE, MIEEE

Israel Korn, MSc DSc *Technion, Haifa*, MIEEE

Christopher John Elliott Phillips, BSc BE PhD *Syd.*, CEng, MIEE, MIEEE, MIREE

Robert Radzyner, BE *Melb.*, MEngSc PhD *N.S.W.*, SMIEEE, MIREE

Ramutis Anthony Zakarevicius, BSc BE MEngSc PhD *Syd.*, MIEAust, MIEEE, MIREE

Lecturers

William John Dewar, MSc(Eng) *Qu.*, PhD *N.S.W.*

Harold Leslie Humphries, BSc BE BEc *Syd.*, MIEAust, MIREE

Professional Officers

Douglas Hamilton Irving, BE *N.S.W.*

Kirill Poronnik, BE *N.S.W.*, ASTC, MIREE

Trevor Wayne Whitbread, BE *N.S.W.*

Department of Computer Science

Associate Professor

Alan Dunworth, BSc PhD *Manc.*, SMIEEE, FIREE

Senior Lecturers

John Lions, BSc *Syd.*, PhD *Camb.*

Graham Barry McMahon, BSc *Syd.*, PhD *N.S.W.*

Peter Clive Maxwell, MSc *Auck.*, PhD *A.N.U.*, MIEEE

Lecturers

Paul William Baker, BE PhD *N.S.W.*

Brian Louis Cohen, BSc PhD *N.S.W.*, MIEEE

Ian James Hayes, BSc *N.S.W.*

Graham Reginald Hellestrand, BSc *N.S.W.*

Leslie Charles Hill, BE *N.S.W.*, MIEAust

Kenneth Arthur Robinson, BSc BE *Syd.*

Professional Officers

Peter Ivanov, BSc MEngSc *N.S.W.*

Serge Poplavsky, Dipling *Bratislava*, ME *N.S.W.*

Keith William Titmuss, BSc(Tech) MEngSc *N.S.W.*

Department of Electric Power Engineering

Associate Professors

Garth Claud Dewsnap, MEE *Melb.*, CEng, FIEE, MIEAust

Gordon William Donaldson, BE *Qld.*, BSc MA *Oxf.*, CEng, MIEE, MIEAust

Gregory Joseph Johnson, MSc *Syd.*, SMIEEE, CEng, MIEE, AAIP

Ian Francis Morrison, BSc BE PhD *Syd.*, CEng, MIEAust, MIEEE, MIEE

Senior Lecturers

Trevor Robert Blackburn, BSc *Adel.*, PhD *Flin.*, GAIP

David Bruce Goudie, BSc BE PhD *Syd.*, MIEEE, AMIEE

Harry Harrison, BSc BE *Syd.*, ME *N.S.W.*, MIEAust

Ronald Edward James, BSc(Eng) PhD *Lond.*, CEng., MIEE, MIMechE

Lecturers

David Gosden, ME *N.S.W.*, MIEAust

Hugh Ronald Outhred, BSc BE PhD *Syd.*, AMIEE

Professional Officers

Joseph Rhine Kinard, BA *Fla.S.U.*, MS *Mass.*, MIEEE, MOSA

Edward Douglas Spooner, ME *N.S.W.*

Department of Solid-State Electronics

Senior Lecturers

Henry Stanley Blanks, BSc ME *Syd.*, PhD *N.S.W.*, CEng, MIREE, MIQA, SMIEEE

Martin Andrew Green, BE MEngSc *Qld.*, PhD *McM.*

Peter Howard Ladbrooke, BTech *Lough.*, PhD *Camb.*

John Alan Richards, BE PhD *N.S.W.*, MIREE, MIEEE

Richard Vaughan, BSc BE PhD *Syd.*

Professional Officer

Peter Bohdan Kosel, BSc *Syd.*, PhD *N.S.W.*, MIEEE

Department of Systems and Control

Associate Professors

John Barry Hiller, BE PhD *N.S.W.*, FIREE

Colin Arthur Stapleton, BSc BE *Syd.*, CEng, MIEE, MIEEE, MIEAust

Keith Eugene Tait, BE BSc *N.Z.*, PhD *N.S.W.*, MIEAust

Senior Lecturers

Peter Thomas Bason, ME PhD *N.S.W.*, MIEEE, MIREE

Reginald Frederick Brown, BEng *Liv.*, PhD *N.S.W.*, CEng, MIEE

Felix Lewin, BSc BE *Syd.*

David Harold Mee, BSc BE *Syd.*, PhD *Lond.*, DIC, MIREE

Darrell Williamson, BSc ME *N'cle.(N.S.W.)*, PhD *Harv.*

Lecturer

Kevan Charles Daly, BSc BE PhD *N.S.W.*

Professional Officers

Kevin John Flynn, BE MEngSc *N.S.W.*, ASTC

Kong Been Lee, BE MEngSc *N.S.W.*, MIEEE, AMIEE

Johan Herman Sieuwerts, BE *N.S.W.*, ASTC

School of Mechanical and Industrial Engineering

Professor of Mechanical Engineering, Head of School and of Departments of Applied Mechanics and Agricultural Engineering

Noel Levin Svensson, MMechE PhD *Melb.*, CEng, FIEAust, MIMechE, AMIM, MACPSM

Nuffield Professor of Mechanical Engineering and Head of Department of Fluid Mechanics/Thermodynamics

Raymond Alfred Arthur Bryant, ME *N.S.W.*, ASTC, CEng, FIMechE, FIEAust, MRAeS

Professor of Mechanical Engineering (on leave)

Peter Thomas Fink, CBE, BE *Syd.*, CEng, FTS, FIEAust, FIMechE, FRAeS, FRINA, MAIAA

Sir James Kirby Professor of Production Engineering

Peter Louis Brennan Oxley, BSc PhD *Leeds*, CEng, FIProdE, FIEAust, MIMechE

Professor of Operations Research and Head of Department of Industrial Engineering

George Bennett, BA *Syd.*, PhD *N.S.W.*, ASTC, CEng, FIProdE

Executive Assistant to Head of School

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Senior Administrative Officer

George Dusan, BEc *Syd.*

Honorary Associate

Cyril Arthur Gladman, BSc(Eng) *Lond.*, ACGI, CEng, FIProdE, MIMechE, MIED

Tutor

Peter Thomas Bath, BE MEngSc *N.S.W.*

Teaching Fellows

Thao Doan, BE *N.S.W.*

See Seng Leong, BE *N.S.W.*

Lyle John McLean, BSc(Eng) MEngSc *N.S.W.*, GradIEAust

Nan Hung Pan, BE *N.S.W.*

Professional Officers

Vaclav Becvar, ME *Prague*

Eric Arthur Carter, BE MEngSc *N.S.W.*, ASTC

Walter Dollar, ASTC

Thomas Done, BA *Macq.*

Joseph Yuk Ming Fung, BE MEngSc *Syd.*, GradIEAust

Anthony Gordon Harris, BSc *Exe.*

Khoi Hoang, BE *Saigon*, PhD *N.S.W.*

Alexander Litvak, Dipling *Odessa*, MIEAust

Barrie Clifford Motson, BE *N.S.W.*, ASTC, MIEAust

Colin Barrington Smith, BE MEngSc *N.S.W.*, ASTC, MAIRAH, GradIEAust

Department of Agricultural Engineering

Senior Lecturer

Harold Glenn Bowditch, ME *N.S.W.*, ASTC, MIEAust

Lecturer

Ronald Arthur Dennis, MSc *Nott.*, CEng, MIMechE

Department of Applied Mechanics

Associate Professor

John Young Harrison, BE *Syd.*, PhD *N.S.W.*, MIEAust

Senior Lecturers

John Edward Baker, MSc *Syd.*, BE MEngSc PhD *N.S.W.*

Kerry Patrick Byrne, BE MEngSc *Qld.*, BSc *Melb.*, PhD *S'ton*

Jacob Alexander Bruce Cartmel, MSc *Cran.I.T.*, PhD *N.S.W.*, CEng, FIMechE, FIEAust, MASME, MIEEE

Donald Jabez Stephen Mudge, BSc *Lond.*, DipEd *N.S.W.*, CEng, MIMechE, MIEAust, WhSc

Alexander Eric Churches, BE PhD *N.S.W.*, ASTC

Eric Joseph Hahn, BE BSc PhD *N.S.W.*, MASME

Edward Colvyn Hind, ME *N.S.W.*, ASTC, MIEAust, MIMechE, MInstMC

Lecturers

Raymond Albert Vincent Byron, BE *Syd.*, CEng, MRAeS, MAIAA

George Crawford, BE BSc *N.S.W.*, ASTC, CEng, FIEAust, ARACI

Robin Arthur Julian Ford, BSc(Eng) PhD *Lond.*, ACGI

Richard Butler Frost, BE *N.S.W.*, MIEAust

Knut Kjorrefjord, BSc *Durh.*, CEng

Farrokh Mistree, BTech *I.I.T. Kharagpur*, MS PhD *Calif.*

Hugh Lithgow Stark, BSc PhD *Strath.*, CEng, MIMechE, MIEAust

Jae Lin Woo, BSc *Seoul*, SM *M.I.T.*, PhD *N.S.W.*

Department of Fluid Mechanics and Thermodynamics

Includes Aeronautical Engineering and Naval Architecture.

Associate Professors

Richard Douglas Archer, BSc *Melb.*, BE *Syd.*, MS PhD *Minn.*, FBIS, MIEAust, MAIAA, MRAeS

Graham de Vahl Davis, BE *Syd.*, PhD *Camb.*, CEng, FIMechE, FIEAust, MASME

Senior Lecturers

Michael Richard Davis, BSc(Eng) PhD *S'ton*, CEng, MRAeS

Lawrence Julian Doctors, BE MEngSc *Syd.*, PhD *Mich.*, AMCASI, AMSNAME

John Newton Hool, BE *Syd.*, DPhil *Oxf.*, ASTC, CEng, FIMechE, MIEAust

Owen Francis Hughes, SB SM(NavArch) *M.I.T.*, PhD *N.S.W.*, MIEAust, MRINA, MSNAME

Robert Taggart Black McKenzie, MS ME *Purdue*, CEng, ARCST(Glas), FIMechE

Brian Edward Milton, BE PhD *N.S.W.*, MSc *Birm.*, CEng, MIEAust, MRAeS

Graham Lindsay Morrison, BE PhD *Melb.*

John Arthur Reizes, ME PhD *N.S.W.*, MIEAust

Charles Matthew Sapsford, BSc(Eng) *Lond.*, ME *N.S.W.*, CEng, MIMechE

Lecturer

Francis Grindal Bartlett, MSc *Mich.*

Department of Industrial Engineering

Includes Operations Research and Production Engineering.

Associate Professors

Michael Geoffrey Stevenson, BSc(Tech) PhD *N.S.W.*, ASTC, CEng, FIEAust, MIProdE

Jack Taylor, BSc *Nott.*, CEng, FIMechE

Senior Lecturers

Leonard Edward Farmer, BE MEngSc PhD *N.S.W.*, MIEAust

Thomas Richard Jefferson, MSc *Tor.*, PhD *Northwestern*

Grier Cheng Lin, DipMechEng *P.T.I.T., Taiwan*, PhD *N.S.W.*, MIEAust

Bruce Albert Murtagh, ME *Cant.*, PhD *Lond.*, DIC, CEng, MIChemE

Raymond Norman Roth, BE PhD *N.S.W.*, CEng, MIEAust

Carlton Henry Scott, BSc *Qld.*, PhD *N.S.W.*

Graham Smith, BE MEngSc PhD *N.S.W.*, ASTC, MIEAust

Lecturer

Daniel Goodridge, DiplIngChim *L'Aurore, Shanghai*, DiplndEng *N.S.W.*

School of Nuclear Engineering

Professor of Nuclear Engineering and Head of School

James Joseph Thompson, BE PhD *Syd.*, FIEAust

Associate Professors

Paul Robert Barrett, MSc PhD *Birm.*, FAIP, MInstP

Zdenek Josef Holy, DipIng *Prague*, MSc *Birm.*, MEngSc PhD *N.S.W.*, MIEAust

Senior Lectufer

Leslie George Kemeny, BE *Syd.*, MIEAust

Lecturer

Olaf Oscar Carlos Alexander Bils, DipIng *Berl.*, PhD *N.S.W.*

Professional Officer

Peter Yo Pin Chen, BSc MEngSc ME PhD *N.S.W.*, ASTC

School of Surveying

Professor of Surveying, Head of School and of Department of Geodesy

Peter Vincent Angus-Leppan, BSc(Eng) *Rand.*, PhD DipTP *Natal*, FISAust, MILS(Natal), MAIC

Professor of Surveying and Head of Department of Photogrammetry

Robert Brewster Forrest, BA *Minn.*, DGeodSci *Ohio State*

Associate Professor of Surveying and Head of Department of Surveying

George Gordon Bennett, MSurv *Melb.*, PhD *N.S.W.*, RegSurv(NSW), FISAust, MIN

Administrative Officer

Joseph Valentine Fonseka, BA *Lond.*

Professional Officers

Norman John Brinsden, BE *N.S.W.*

Linda Louise Dawson, BSc *Syd.*

Colin Edward Wardrop, BSc *N.S.W.*

Department of Geodesy

Senior Lecturers

Friedrich Karl Brunner, DipIng Dr techn *T.U. Vienna*

Arthur Harry William Kearsley, BSurv MSurvSc PhD *N.S.W.*, MAIC, MISAust

Artur Stolz, BSurv PhD *N.S.W.*, RegSurv(NSW)

Department of Photogrammetry

Includes Land Studies and Cartography.

Associate Professors

George James Forster Holden, DipPhoto *Lond.*, PhD *N.S.W.*, FRGS, FRICS, MISAust, MAIC

John Charles Trinder, BSurv PhD *N.S.W.*, MSc *I.T.C. Delft*, RegSurv(NSW), MISAust

Senior Lecturer

Bruce Crosby Forster, MSurv *Melb.*, MSc *R'dg.*, MISAust, LS(Vic)

Lecturers

Pratap Shivabhai Amin, BSc *T.H. Delft*, MSc *Lond.*, MISAust. MISK, CLSEA, ARICS

Leonard Berlin, BSc(LS) *Cape T.*, BSc *T.H. Delft*

Lynn Charles Holstein, MIS *N.Z.*, DipPhotogram *U.C.L.*, RegSurv(NSW), ARICS

Ian Philip Williamson, BSurv MSurvSc *N.S.W.*, RegSurv(NSW). MISAust

Department of Surveying

Associate Professor

John Stuart Allman, BSurv PhD *N.S.W.*, MISAust, MAIC

Senior Lecturer

Anthony John Robinson, BSurv MBA PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC

Lecturers

Sabapathy Ganeshan, BSc *Ceyl.*, MISAust

Klaas Ids Groenhout, BSurv MSurvSc *N.S.W.*, RegSurv(NSW) MISAust, AMAIC

Gregory Justin Hoar, BSurv PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC

John Richard Pollard, BSc *Qld.*, BTech *S.A.I.T.*

Jean Marc Rueger, Dipling *E.T.H. Zurich*, SIA, LS(Switz), MISAust

Tutors

Paul Charles Covell, BSurv *N.S.W.*

Thomas Sinclair Morrison, BSurv *N.S.W.*, RegSurv(NSW)

School of Transport and Highways

Professor of Traffic Engineering and Head of School

William Ross Blunden, BSc BE *Syd.*, FCIT(Lond), FITE(Wash), FIEAust, MStatSocAust

Senior Lecturers

Alec James Fisher, BSc *Lond.*, PhD *N.S.W.*, FIESAust

Robert Alexander Jones, BE *W.Aust.*, ME *Auck.*, MSc *Lond.*, DIC, MSINZ, MIEAust, LS(NZ)

Ross Donald Munro, BSc *W.Aust.*, BA *Melb.*, FSS

Brian Shackel, BE *Sheff.*, MEngSc PhD *N.S.W.*, MIEAust, MASCE

Theo ten Brummelaar, BE MEngSc *N.S.W.*, MIEAust

John Irwin Tindall, BE *Qld.*, BCom ME *N.S.W.*, AMIEAust

Lecturers

John Andrew Black, BA *Manc.*, PhD *Brad.*, MTCP *Syd.*, AMIT

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.*

Centre for Biomedical Engineering

Director

Associate Professor Peter Craig Farrell, BE *Syd.*, SM *M.I.T.*, PhD *Wash.*, MASAIO, MISAO

Administrative Assistant

Anne Ricketts, BA *N.S.W.*

Professional Officer

Walter Flicker, BE *N.S.W.*

Honorary Visiting Fellow

Tibor Timothy Vajda, DDS *Bud.*, FRSM, FACBS

Broken Hill Division

Staff

Director
Professor J. E. Andersen

W.S. and L.B. Robinson University College

Head of Department of Science
Professor John Everard Andersen, BE *Melb.*, PhD *N.S.W.*, FIEAust, MAusIMM, ARACI

Head of Department of Mining and Mineral Sciences
Professor Leon John Thomas, BSc PhD *Birm.*, CEng, FIEAust, MAusIMM, MIMinE

Department of Mining and Mineral Sciences

Professional Officer
Kenneth James Murray, BSc *Syd.*, MSc *N.S.W.*, AMAusIMM

Mechanical Engineering

Lecturers
Llewellyn Ramsay Jones, BSc *N.Z.*, DipAm MEng *Sheff.*, PhD *Wales*, MIEAust, MIMechE
Ian Lachlan Maclaine-cross, BE *Melb.*, PhD *Monash*, MIEAust, MAIRAH, MSES
Chakravarti Varadachar Madhusudana, BE *Mys.*, ME *I.I.Sc.*, PhD *Monash*, MIEAust

Mining Engineering

Senior Lecturer
Venkata Satyanarayana Vutukuri, BSc(Eng) *Ban.*, MS *Wis.*, MMGI, AIME, AMAusIMM

Mineral Science

Senior Lecturer
Barenya Kumar Banerji, MSc *Patna*, PhD *Leeds*, MAusIMM

Geology

Senior Lecturer
Gerrit Neef, BSc *Lond.*, PhD *Well.*, FGS

Lecturers
Ian Rutherford Plimer, BSc *N.S.W.*, PhD *Macq.*, AMAusIMM, AMIMM
Kevin David Tuckwell, BSc PhD *N.S.W.*, AMAusIMM

Department of Science

Chemistry

Lecturer
Derek Richard Smith, BSc PhD *Wales*

Senior Tutor
Robert Edward Byrne, MSc *N.S.W.*, ARACI, AMAusIMM

Mathematics

Senior Lecturer
Zdenek Kviz, DipPhys *Brno*, CSc RerNatDr *Charles*, PhD *Prague*

Lecturers
David Charles Guiney, BSc PhD *Adel.*
Dennis William Trenerry, BSc PhD *Adel.*

Physics

Senior Lecturer
Robert John Stening, MSc *Syd.*, PhD *Qld.*, DipTertEd *N.E.*, MAIP

Lecturer
Kenneth Reid Vost, BSc *Glas.*, MSc *N.S.W.*, AMAusIMM

Fowlers Gap Research Station

Officer-in-Charge
John Alfred Reynolds, BSc PhD *N.S.W.*

The University of New South Wales Kensington Campus 1980

Theatres

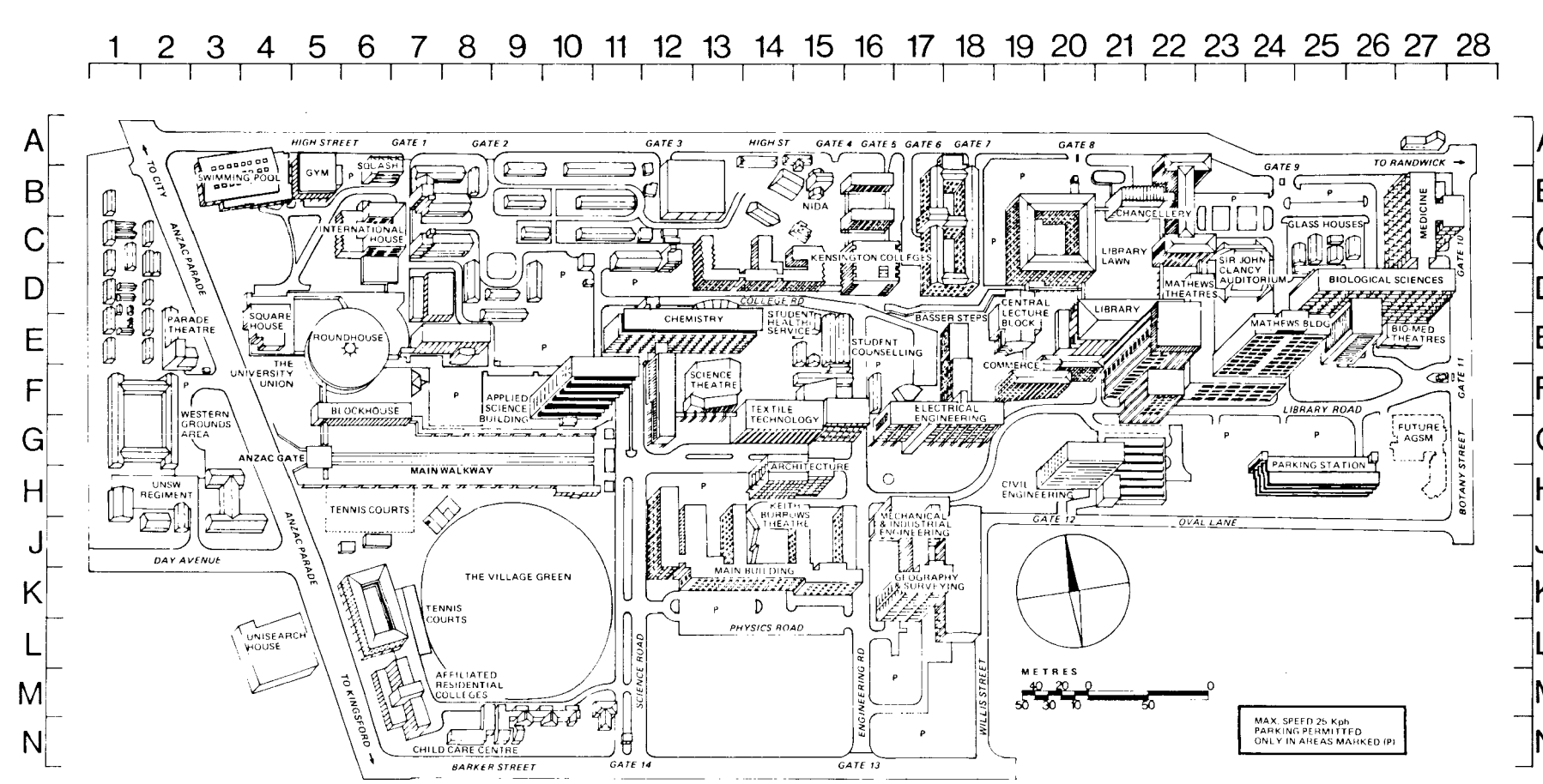
Biomedical Lecture Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Electrical Engineering Theatre F17
Keith Burrows Lecture Theatre J14
Mathews Theatres D23
Old Main Theatrette K14
Parade Theatre E3
Science Theatre F13
Sir John Clancy Auditorium C24

Buildings

Affiliated Residential Colleges
New (Anglican) L6
Shalom (Jewish) N9
Warrane (Roman Catholic) M7
Applied Science F10
Architecture H14
Arts (Morven Brown) C20
Banks F22
Barker Street Gatehouse N11
Basser College C18
Biological Sciences D26
Central Store B13
Chancellery C22
Chemistry
Dalton F12
Robert Heffron E12
Civil Engineering H20
Commerce (John Goodsell) F20
Dalton (Chemistry) F12
Electrical Engineering G17
Geography and Surveying K17
Goldstein College D16
Golf House A27
Gymnasium B5
House at Pooh Corner N8
International House C6
John Goodsell (Commerce) F20
Kensington Colleges C17
Basser C18
Goldstein D16
Philip Baxter D14
Main Building K15
Maintenance Workshop B13
Mathews F23
Mechanical and
Industrial Engineering J17
Medicine (Administration) B27
Menzies Library E21
Metallurgy E8
Morven Brown (Arts) C20
New College (Anglican) L6
Newton J12
Parking Station H25
Philip Baxter College D14
Robert Heffron (Chemistry) E12
Sam Cracknell Pavilion H8
Shalom College (Jewish) N9
Sir Robert Webster
(Textile Technology) G14
Squash Courts B7
Swimming Pool B4
Unisearch House L5
University Regiment J2
University Union
(Roundhouse) — Stage I E6
University Union
(Blockhouse) — Stage II G6
University Union
(Squarehouse) — Stage III E4
Wallace Wurth School of Medicine C27
Warrane College (Roman Catholic) M7
Wool and Pastoral Sciences B8

General

Accountancy F20
Admissions Office C22
Anatomy C27
Applied Geology F10
Applied Science (Faculty Office) F10
Appointments Office C22
Architecture
(including Faculty Office) H14
Arts (Faculty Office) C20
Australian Graduate
School of Management F23
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biological Technology D26
Biomedical Library F23
Bookshop G17
Botany D26
Building H14
Cashier's Office C22
Centre for Medical Education
Research and Development C27
Chaplains E15a
Chemical Engineering F10
Chemical Technology F10
Chemistry E12
Child Care Centre N8
Civil Engineering H20
Closed Circuit Television Centre F20
Commerce (Faculty Office) F20
Committee in Postgraduate Medical
Education B27
Community Medicine D26
Computing Services Unit E21
Drama D9
Economics F20
Education G2
Electrical Engineering G17
Engineering (Faculty Office) K17
English C20
Examinations and Student Records C22
Fees Office C22
Food Technology F10
French C20
General Studies C20
Geography K17
German C20
Graduate School of the Built
Environment H14
Health Administration C22
History C20
History and Philosophy of Science C20
Industrial Arts C1
Industrial Engineering J17
Institute of Languages G14
Institute of Rural Technology B6
Kindergarten *(House at Pooh Corner/*
Child Care Centre) N8
Landscape Architecture H14
Law (Faculty Office) E21
Law Library E21
Librarianship B10
Library E21
Lost Property F20
Marketing F20
Mathematics F23
Mechanical Engineering J17
Medicine (Faculty Office) B27
Metallurgy E8
Microbiology D26
Mining Engineering K15
Music B11
National Institute of Dramatic Art C15
Nuclear Engineering G17
Optometry J12
Organizational Behaviour F20
Pathology C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K15
Physical Education and
Recreation Centre (PERC) B5
Physiology and Pharmacology C27
Political Science C20
Postgraduate Extension Studies (Closed
Circuit Television) F20
Postgraduate Extension Studies (Radio
Station and Administration) F23
Psychology F23
Public Affairs Unit C22
Regional Teacher Training Centre C27
Russian C20
Science and Mathematics Course
Office F23
Social Work E1
Sociology C20
Spanish and Latin American Studies C20
Student Amenities and Recreation E15c
Student Counselling and Research E15c
Student Employment C22
Student Health E15
Students' Union E4
Surveying K17
Teachers' College Liaison Office F16
Tertiary Education Research Centre E15d
Textile Technology G14
Town Planning K15
University Union (Blockhouse) G6
Wool and Pastoral Sciences B8
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
HIGH STREET
GATE 1
GATE 2
GATE 3
HIGH ST
GATE 4
GATE 5
GATE 6
GATE 7
GATE 8
GATE 9
TO RANDWICK
TO CITY
ANZAC PARADE
SWIMMING POOL
GYM
SPLASH HOUSE
INTERNATIONAL HOUSE
NIDA
KENSINGTON COLLEGES
CHANCELLERY
LIBRARY LAWN
GLASS HOUSES
MEDICINE
GATE 10
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNION
COLLEGE RD
CHEMISTRY
STUDENT HEALTH SERVICE
BASSER STEPS
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO-MED THEATRES
STUDENT COUNSELLING
COMMERCE
SCIENCE THEATRE
APPLIED SCIENCE BUILDING
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
GATE 11
LIBRARY ROAD
FUTURE AGSM
BOTANY STREET
BLOCKHOUSE
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
CIVIL ENGINEERING
UNSW REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
GEOGRAPHY & SURVEYING
TENNIS COURTS
PHYSICS ROAD
UNISEARCH HOUSE
AFFILIATED RESIDENTIAL COLLEGES
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
TO KINGSFORD
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)

This Handbook has been specially designed as a source of reference for you and will prove useful for consultation throughout the year.

For fuller details about the University – its organization, staff membership, description of disciplines, scholarships, prizes, and so on, you should consult the Calendar.

The Calendar and Handbooks also contain a summary list of higher degrees as well as the conditions for their award applicable to each volume.

For detailed information about courses, subjects and requirements of a particular faculty you should consult the relevant Faculty Handbook.

Separate Handbooks are published for the Faculties of Applied Science, Architecture, Arts, Commerce, Engineering, Law, Medicine, Professional Studies, Science (including Biological Sciences and the Board of Studies in Science and Mathematics), the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education.

The Calendar and Handbooks are available from the Cashier's Office. The Calendar costs $3.50 (plus postage and packing, 90 cents). The Handbooks vary in cost. Applied Science, Arts, Commerce, Engineering and Sciences are $2.50. Architecture, Law, Medicine, Professional Studies and AGSM are $1.50. Postage is 40c in each case. The exception is General Studies, which is free.