The University of New South Wales

Engineering

1978
Faculty Handbook

Arms of

The University of New South Wales

Granted by the College of Heralds, London
3 March 1952

Heraldic Description of Arms

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

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

The University of New South Wales

Engineering

1978 Handbook

The address of the University of
New South Wales is:

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General Information

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

This Handbook has been specially designed as a detailed source of reference for you in all matters related to your Faculty. The **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.

Now, see the following pages for other general information which may be of value to you.

Some people who can help you

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

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, Mr Stephen Briand, 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 Mr Briand. Enquire at room 148E, phone 2482 (general enquiries) or 3164 (financial assistance).

The Assistant Registrar (Examinations and Student Records Section), Mr John Warr, is located on the ground floor of the Chancellery. Assistance can also be obtained from the Senior Administrative Officer, Mr Ross Woodham. 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, contact Mr Jack Morrison, phone 3711. For information regarding examinations, including examination timetables and clash of examinations, contact Mr John Grigg, phone 2143.

The Assistant Registrar (Admissions and Higher Degrees Section), Mr Jack Hill, is located on the ground floor of the Chancellery. For particular enquiries regarding *undergraduate courses* phone Mr John Beauchamp on 3319. General enquiries should be directed to 3711.

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 on the ground floor of 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 Unit in Hut B at the foot of Basser Steps. For assistance in obtaining *suitable lodgings* phone 3260.

The Student Health Unit is located in Hut E on College Road. 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. The Head is Mr George Gray. 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; Church of Christ—2683; The Uniting Church—2683; Seventh Day Adventist—2683; Jewish—3273; Baptist—398 4065.

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 or 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), AUS insurance (including health), 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

1978

Session 1	6 March to 14 May
(14 weeks)	*May Recess:* 15 May to 21 May
	22 May to 18 June
Monday 19 June	Examinations begin
Friday 1 July	Examinations end
	Midyear Recess: 19 June to 23 July
Session 2	24 July to 27 August
(14 weeks)	*August Recess:* 28 August to 3 September
	4 September to 5 November
	Study Recess: 6 November to 12 November
Monday 13 November	Examinations begin
Friday 2 December	Examinations end

January

Monday 2	New Year's Day—Public Holiday
Friday 6	Last day for application for review of results of *annual* examinations
Monday 9	Publication of timetable for *deferred* examinations
Friday 13	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 30	Australia Day—Public Holiday
Tuesday 31	*Deferred* examinations begin

February

Saturday 4	*Deferred* examinations end
Friday 17	*Deferred* examination results available
Monday 20	Enrolment period begins for new students and students repeating first year
Wednesday 22	Last day for application for review of *deferred* examination results
Friday 24	Last day for 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 reason
Monday 27	Enrolment period begins for second and later year students

March

Monday 6	**Session 1 commences**
Tuesday 7	List of graduands for April/May ceremonies published in daily press
Friday 24 to Monday 27	Easter
Friday 31	Last day for students, other than those attending the University for the first time, to discontinue without failure subjects which extend over Session 1 only

April

Tuesday 25	Anzac Day—Public Holiday
Friday 28	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 1 only
	Confirmation of Enrolment forms despatched to all students

May

Thursday 11	Last day for acceptance of corrected *Confirmation of Enrolment* forms
	Last day for students completing requirements for degrees or diplomas at the end of Session 1 to submit *Details Associated With Graduation* form
Monday 15	**May Recess begins**
Thursday 18	Publication of provisional timetable for June/July examinations
Friday 19	Last day for students, other than those attending the University for the first time, to discontinue without failure subjects which extend over the whole academic year
Sunday 21	**May Recess ends**
Tuesday 30	Last day for students to advise of examination timetable clashes

June

Tuesday 6	Publication of timetable for June/July examinations
Monday 12	Queen's Birthday—Public Holiday
Sunday 18	**Session 1 ends**
Monday 19	**Midyear Recess begins**
	Examinations begin
Friday 30	Examinations end

July

Monday 17	Examination results mailed to students
Tuesday 18	Examination results displayed on University notice boards
Wednesday 19 to Friday 21	Students to amend enrolment programs following receipt of June examination results
Sunday 23	**Midyear Recess ends**
Monday 24	**Session 2 begins**
	Last day for 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 reason
Friday 28	Last day for application for review of June examination results

August

Thursday 3	Foundation Day
Friday 4	Last day for students attending the University for the first time to discontinue without failure subjects which extend over the whole academic year
Friday 18	Last day for students, other than those attending University for the first time, to discontinue without failure subjects which extend over Session 2 only
Monday 28	**August Recess begins**

September

Sunday 3	**August Recess ends**
Monday 11	Last day for applications from students completing requirements for degrees and diplomas at the end of Session 2 to submit *Details Associated with Graduation* form
Wednesday 13	List of graduands for October graduation ceremonies published in daily press
Friday 15	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 2 only
	Confirmation of Enrolment form forwarded to all students
Monday 18	Last day to notify intention of attending October graduation ceremony

October

Sunday 1	Last day to apply to MUAC for transfer to another University in New South Wales
Monday 2	Eight Hour Day—Public Holiday
	Last day to return corrected *Confirmation of Enrolment* forms
Thursday 5	Publication of provisional examination timetable
Thursday 12	Graduation ceremonies
Tuesday 17	Last day for students to advise of examination timetable clashes
Tuesday 24	Publication of timetable for annual examinations

November

Sunday 5	**Session 2 ends**
Monday 6	**Study Recess begins**
Monday 13	Examinations begin.

December

Friday 2	Examinations end
Tuesday 19	Examination results mailed to students
Wednesday 20	Examination results displayed on University notice boards
Monday 25	Christmas Day—Public Holiday
Tuesday 26	Boxing Day—Public Holiday

1979

Session 1	5 March to 13 May
	May Recess: 14 May to 20 May
	21 May to 17 June
Monday 18 June	Examinations begin
Saturday 30 June	Examinations end
	Midyear Recess: 18 June to 22 July
Session 2	23 July to 26 August
	August Recess: 27 August to 2 September
	3 September to 4 November
	Study Recess: 5 November to 11 November
Monday 12 November	Examinations begin
Saturday 1 December	Examinations end

January

Monday 1	Public Holiday
Friday 5	Last date for application for review of results of *annual* examinations
Friday 12	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 29	Australia Day—Public Holiday

February

Monday 19	Enrolment period begins

The Academic Year

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

Session 1 commences on the first Monday of March.

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 1977 the University had 18,520 students and over 4,000 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.

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 43 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 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 Rex Vowels and Professor Albert Willis; 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.

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

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 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-readable identification card to borrow from the University libraries. For students, a current union card is acceptable. Staff must apply to the library for a library card.

Accommodation

Residential Colleges

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

The Kensington Colleges

The Kensington Colleges comprise Basser College, Goldstein College, and Philip Baxter College. They house 450 men and women students, as well as 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. 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 International Catholic lay association Opus Dei. Apply in writing to the Master, Warrane College, PO Box 123, Kensington, NSW 2033.

Creston Residence

Creston, associated with Warrane College, offers residence for 25 full-time undergraduate and graduate women students of all nationalities and denominations. It is directed by the Women's Section of Opus Dei, a Catholic lay association. Further information: 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 Unit 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, lists of estate agents and hints on house-hunting are available on request.

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

Student Employment and Scholarships

The Student Employment and Scholarships Unit 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, undergraduate and graduate scholarships is also available.

The service is located in Room G19 of 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 arrangeed to suit the student's time and convenience.

Student Amenities and Recreation

In general the Student Amenities and Recreation Unit 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 Unit 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 Unit is located in Hut B 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 Unit provides a recreational program for students and staff at the Physical Education and Recreation Centre. The Centre consists of eight squash courts and a main building, the latter containing a large gymnasium and practice rooms for fencing, table tennis, judo, weight-lifting, karate and jazz ballet, also a physical fitness testing room. The recreational program includes intramurals, teaching/coaching, camping, 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 $6 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 Hut G, near the bottom of Basser Steps, and the control of the Sports Association is vested in the General Committee. The Executive Officer of the Sports Association may be contacted on extension 2673.

Student Travel Concessions

The Student Amenities and Recreation Unit 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 SARU, Hut B, (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 $45 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 two years at the University are eligible for election.

A full-time President, elected each year by popular ballot, directs the entire administration of the Students' Union and its activities, through the permanent Administrative Officer.

Other full-time officers include the **Education Vice-President** who works towards the implementation of Student Union education policy and in assisting 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.

Both are elected by students with the latter elected by overseas students.

Membership is compulsory at $14 per annum for full-time students and $11 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 affiliated with the Australian Union of Students (AUS) which represents students on the national level.

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 notice boards for details.

Australian Armed Forces Enquiries should be directed to:

Royal Australian Navy: Royal Australian Navy Liaison Officer, Professor J. S. Ratcliffe, Commander, RANR, at the School of Chemical Engineering. Phone extension 2406.

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.

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

- Undergraduate and graduate degree courses
- Graduate diplomas
- Approved combined Bachelor degree courses
- Master's qualifying courses

Benefits (as at 30 June 1977)

Means-tested Living Allowance The maximum rates of living allowances are $1,250 per annum for students living at home and $1,976 per annum for students living away from home. The maximum rate for independent students is $2,236 per annum. The maximum rates of living allowance will be paid where the adjusted family income is equal to *or* less than $8,200 per annum. The adjusted family income is assessed by subtracting from the gross income of both parents their business expenses and an amount of $450 for each dependent child other than the student.

When the adjusted family income exceeds $8,200 pa the amount of living allowance will be reduced by $2.50 for every $10 of income.

A concession may be made where there are other children in the family undertaking tertiary education with scholarship assistance from schemes other than the Tertiary Education Assistance Scheme of less than $150 pa.

Students qualifying for living allowance will also receive the following allowances where appropriate:

Incidentals Allowance The Incidentals Allowance of $100 is designed to help the student meet the cost of those fees which have not been abolished: the Students' Union, University Union and Sports Association fees, and other expenses associated with their studies.

Travel Allowance Students whose home is in the country may be reimbursed the cost of three return trips per year, during vacation time.

Dependants' Allowance This is made up of allowances of $29 per week for a dependent spouse and $7.50 per week for each child.

How to Apply 1977 Higher School Certificate candidates and tertiary students receiving an allowance were sent forms last October. Other students may obtain forms from the Admissions Section or the Student Employment and Scholarships Unit, or from the Regional Director, Department of Education, 323 Castlereagh Street, Sydney, NSW 2000 (phone 218 8800). The administrative closing date for 1978 applications is 31 October 1977.

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 School office.

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

2. *Graduate Awards* An honours 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 University 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.

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.

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 from a number of sources to help Aboriginal students. Apart from the Commonwealth Government's Tertiary Education Assistance Scheme there is a Commonwealth Aboriginal Study Grant Scheme. Furthermore, the University may assist Aboriginal students with some essential living expenses in exceptional circumstances.

All enquiries relating to this scheme 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 Requirements for Admission), from students seeking admission with advanced standing, and 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 Metropolitan Universities Admissions Centre.

How do I qualify for 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 a pamphlet obtainable at the Admissions Office and in the Calendar.

Enrolment

How do I enrol?

All students, except those enrolling in graduate research degrees (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 their course requires this.

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

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 in writing 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). Payment may be made through the mail in which case it is important that the student registration number be given accurately.

New Undergraduate Enrolments

Persons who are applying for entry in 1978 must lodge an application for selection with the Metropolitan Universities Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1977.

Those who are selected will be required to complete enrolment at a specified appointment time before the start of Session 1. Compulsory fees must be paid on the day of the appointment. In special circumstances, however, and provided class places are still available, students may be allowed to complete enrolment after the prescribed week, subject to the payment of a penalty (see page 15).

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 Metropolitan Universities Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1977.

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

1977; 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.

New Research Students

Students enrolling for the first time in graduate research degrees will receive an enrolment form by post. They have two weeks from the date of offer of registration in which to lodge the enrolment form with the Cashier and pay the appropriate fees. Completion of enrolment after this time will incur a penalty (see page 15).

Re-enrolling Research Students

Students re-enrolling in research degrees should lodge the enrolment form with the Cashier as soon as possible but no later than the end of the second week of Session 1. Completion of enrolment after that date will incur a penalty (see below).

Submission of Graduate Thesis or Project Report at Commencement of Session 1

A candidate who has completed all the work for a graduate degree except for the submission of a thesis or project report is required to re-enrol and pay fees as outlined above *unless* the thesis or project report is submitted by the end of the second week of Session 1 in which case the candidate is not required to re-enrol. Those required to re-enrol may claim a refund of fees if able to withdraw (see below).

Miscellaneous Subject Enrolments

Students may be permitted to enrol for miscellaneous subjects (ie as students not proceeding to 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 in miscellaneous subjects which may be counted towards courses from which they have been excluded.

Students seeking to enrol in miscellaneous subjects 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.

For details of the locations and hours for enrolment see *Enrolment Procedures 1978*, a free booklet obtainable from your School or Faculty Office or from the Admissions Office.

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 (17 March 1978) 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 (31 March 1978) 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 (4 August 1978) 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 University 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 13 January. 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 1977.

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 Head of the School responsible for the course on forms available from School offices or at the Enquiry Desk in the main entrance of the Chancellery. The Registrar will inform you of the decision. Application to enrol in additional subjects must be submitted by the end of the fourth week of Session 1.

It is emphasized that failure to sit for examinations in any subject in which you are enrolled will be regarded as failure to satisfy the examiners in that subject unless written approval to withdraw without failure has been obtained from the Registrar.

Withdrawal from subjects

Courses

1. Students withdrawing from courses (see also Subjects, below) are required to notify the Registrar in writing.

For details see the Calendar.

Subjects

2. Students are permitted to withdraw from subjects without being regarded as having failed, provided they apply by the dates indicated.

First Year Students (ie enrolled for the first time in any undergraduate course at the University)

1. one-session subjects: the end of the eighth week of that session (28 April or 15 September).

2. double-session subjects: the end of the second week of Session 2 (4 August).

Other Students

1. one-session subjects: the end of the fourth week of that session (31 March or 8 August);

2. double-session subjects: the end of the eleventh week from the start of Session 1 (19 May).

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

If you have had a leave of absence for twelve months 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 October in the year preceding the one in which you wish to resume your course.

If you have not obtained leave of absence from your course and have not been enrolled in the course over the past twelve months or more, then you should apply for admission to the course through the Metropolitan Universities Admission 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 for the first time in any undergraduate course in the University shall be required to show cause why he/she should be allowed to continue the course if that student 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.* Failure in a deferred examination as well as in the initial examination counts for the purposes of this rule as one failure.

General Rule

3. The Re-enrolment Committee may, on the recommendation of the relevant faculty or board of studies, review the academic progress of any student. If that student's academic record seems to demonstrate, in the opinion of the Committee, the student's lack of fitness to pursue a subject or subjects and/or a course or courses, the Committee may require that student to show cause why he/she should be allowed to re-enrol in such subject(s) and/or course(s).

The Session-unit System

4. (1) A student who infringes the provisions 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.

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

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 consituted by Council for this purpose with the following membership:

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

The Chairman of the Professorial Board, or if 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.

(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 account 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 (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 Metropolitan Universities Admission 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.

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.

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 **Submission of Details Associated with Graduation** by the dates shown in the *Calendar of Dates* and on the *Notification of Examination Results*. The forms are available from the Enquiry Counter at 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 Advice* 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. This advice should reach the Registrar no later than 24 July for students completing at the end of Session 1, and 24 February for those completing at the end of Session 2 to ensure that the degree is not conferred.

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 fees for tuition?

No tuition fees are charged.

What other fees and charges are payable?

Apart from the tuition fees (above) 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 procedures 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 their personal use during attendance in certain subjects. Accommodation 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, $25 entrance fee, payable on first enrolment

Student Activities Fees

University Union, $45 annual subscription

Sport Association, $6 annual subscription

Students' Union:

Students enrolling in full-time courses, $14 annual subscription

Students enrolling in part-time courses and miscellaneous subjects, $11 annual subscription

Miscellaneous, $25 annual fee.

The fee is used to finance expenses generally of a capital nature relating to student activities. Funds are allocated to the various student bodies for projects recommended 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 1977 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.

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

Locations and Hours of Cashier

Cashier's Offices are open during the enrolment periods. Details of locations and hours are listed in *Enrolment Procedures 1978*, 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 Students Activities Fees and the University Union entrance fee.

3. University Union fees and subscriptions may be waived by the Deputy Registrar (Student Services) for students enrolled in graduate courses in which the academic requirements require no attendance on the Kensington campus.

4. 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.

5. 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.

6. 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.

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

8. 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 away from the Kensington campus for one or more sessions.

Is exemption from membership possible?

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

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 second-hand 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 (28 April 1978). 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 (1 September 1978).

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 Full 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 University 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 Terminating Pass may be granted where the mark for the subject is below the required standard. A terminating pass will not permit a student to progress further in the subject or to enrol in any other subject for which a pass in the subject is a co-requisite or prerequisite. A student given a terminating pass may attempt a deferred examination, if available, to improve his performance but should he fail in such attempt, the terminating pass shall stand.

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 Information Desk, Chancellery, also by 30 November). Results are also posted on School notice boards and in 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 nave 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 by the dates printed on the reverse side of *Notification of Results.*

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.*

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.*

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, 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 Translation 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 translation 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 10 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. No candidate shall be admitted to an examination after 30 minutes from the time of commencement of the examination.

5. No candidate shall be permitted to leave the examination room before the expiry of 30 minutes from the time the examination commences.

6. No candidate shall be re-admitted to the examination room after he has left it unless during the full period of his absence he has been under approved supervision.

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

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

9. 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.

Under what circumstances are deferred examinations granted?

Deferred examinations may be granted in the following cases:

1. When a student through illness or some other acceptable circumstance has been prevented from taking the annual examination or has been placed at a serious disadvantage during the annual examinations.

2. To help resolve a doubt as to whether a student has reached the required standard in a subject.

3. To allow a student by further study to reach the required standard in a subject.

4. Where a student's progression or graduation is inhibited by his failure in one subject only, a deferred examination may be granted notwithstanding his failure otherwise to qualify for this concession.

In the Faculties of Arts, Commerce and Law special circumstances apply in the granting of deferred examinations. Details in each circumstance are given in the section *Faculty Information* in the respective handbooks for these faculties, or in the Calendar.

Deferred examinations must be taken at the centre at which the student is enrolled, unless he has been sent on compulsory industrial training to a remote country centre or interstate. In this case the student must advise the Registrar, on a form available from his school or the Information Desk, the Chancellery, of relevant particulars, before leaving for his destination, in anticipation that deferred examination papers may have to be forwarded to him. Normally, the student will be directed to the nearest university for the conduct of the deferred examination.

What is a Conceded Deferred Examination?

A conceded deferred examination may be granted to a student where the mark in the subject is below the standard at which deferred examinations have been granted in the subject but whose overall performance warrants' such a concession.

Change in the deferred examination system from March 1978

The system of formal deferred examinations administered by the Registrar's Division will be 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 5c 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 expressions that they use in essays. 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.

However, 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.

Leave of Absence

Applications for leave of absence from lectures should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If examinations have been missed, this should be stated in the application.

If you attend less than 80 per cent of their possible classes, you may be refused permission to sit for the examination in that subject.

Why is my University Union card important?

All students enrolled for courses leading to degrees and/or diplomas, except those exempt from fees, are issued with a University Union membership card. Your card must be carried during attendance 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 quoted in all correspondence.

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

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

New students will be issued with University Union 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 on the Ground Floor of the Chancellery Building.

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 *Submission 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 impracticable to gain the student's prior permission. This happens rarely. This policy is considered so important that it often involves officers of the University in very difficult situations, for example, when they must refuse to reveal the address of a student to parents or other relatives.

In spite of the policy, 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 28 April and 15 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, Chancellery Building.

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 from the Admissions Office, the Student Counselling Unit or the Registrar.

Notices

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

Notices are placed on the University notice boards 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:

Monday 27 February 1978
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:

Tuesday 28 February 1978
11 am in the Clancy Auditorium

Part-time Students

Tuesday 28 February 1978
6.30 pm in the Clancy Auditorium

Meeting for Parents of New Students

Friday 3 March 1978
7.30 pm in the Clancy Auditorium

Foreword

The Faculty of Engineering Handbook

This handbook is primarily for undergraduate students in the Faculty of Engineering and aims to provide information concerning the requirements for admission, enrolment and re-enrolment, conditions for the award of the different Bachelor degrees in the Faculty and the subject matter of the courses offered, including textbooks. **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.

At the same time, it is appreciated that a student's choice in regard to course and other matters remains to be discussed with members of the academic staff. Some students do not need to make their final choice of degree course before the start of third year.

Information Service for Students

Standard programs for courses leading to the award of Bachelor degrees in Aeronautical Engineering*, Civil Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Naval Architecture* and Surveying are contained in the section **Course Outlines** later in this handbook. For further information, students should consult the head of the appropriate school or one of the persons 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* *School of Electrical Engineering* Miss M. Lenthall *School Office*
School of Mechanical and Industrial Engineering	Associate Professor J. Y. Harrison Room 112 Mr G. Dusan Room 107 *School of Mechanical and Industrial Engineering*

*These courses are taught within the School of Mechanical and Industrial Engineering.

School of Surveying .... Mr J. V. Fonseka
School Office
Room 529
South Wing (Extension), School of Mechanical and Industrial Engineering

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.

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, Pavement Engineering and Continuum and Statistical Mechanics. The Materials Laboratories are located at Kensington.

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

The Department of 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, 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

Full-time undergraduate courses leading to the degree of Bachelor of Engineering are offered in Mechanical, Industrial, and Aeronautical Engineering, and in Naval Architecture. Part-time courses leading to the degree of Bachelor of Science (Engineering) are offered in the same four fields. Either degree may be taken out by a combination of full-time/part-time study, subject to approval by the Head of School.

The first two years of the full-time degree, and the first four stages of the part-time degree are common to all 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 Stage 4 for part-time students.

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 courses in Refrigeration and Air Conditioning, and in Industrial Engineering. The Department of Industrial Engineering within the School offers a course leading to 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 for the research degrees of Master of Engineering and Doctor of Philosophy, the School offers a formal graduate course leading to 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 and a sandwich course leading to the degree of Bachelor of Surveying. The full-time course is of 4 years' duration while the sandwich course may be completed in 6 or 7 years. The old part-time course is being phased out and replaced by the sandwich course. 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 Mechanical Engineering Extension Building. Facilities include four photogrammetry laboratories with plotting instruments of various types, an observatory platform for positional astronomy and a comprehensive range of field equipment for surveying and geodesy. Computing facilities include programmable calculators, user terminals and a library of programs for use on the University's Cyber computer.

Current research is in the fields of physical geodesy, photogrammetry, geometrical geodesy, error theory, computer applications, land data banks and cadastral systems.

School of Transport and Highways

The Schools of Transportation and Traffic and Highway Engineering have been amalgamated to the new School of Transport and Highways. The fusing of the disciplines of the separate Schools—the one oriented towards planning and analysis and the other to design and construction—will permit greater flexibility in the choice of MEngSc programs. The new School will continue to offer graduate diplomas and special courses in Transport, Highway Engineering and Traffic Planning & Control. It will supervise research degrees in a wide range of topics including urban and regional planning, highway maintenance, transport systems, transport terminal operators, public transport, land use and transport interactions, environmental impact, road safety, noise and pollution.

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:

Skills

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

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

Communication

- The ability to direct and manage engineering activities.

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

Creativity

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

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

We hope to do much more than merely impart a body of knowledge to our undergraduates. 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. Good opportunities exist for this in *Faculty Hour*, a voluntary series of lectures and discussions on topics touching on the interaction of the engineer and society. This takes place at noon on Mondays in

the Electrical Engineering Theatre LG1. All third and fourth year students, and some others also, will find their timetables free of formal classes at noon on Mondays. Students are urged to use Faculty Hour to broaden their approach to their studies.

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.

P. T. Fink
Dean
Faculty of Engineering

N. L. Svensson
Chairman
Faculty of Engineering

Faculty of Engineering

Staff

Comprises Schools of Civil Engineering, Electrical Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying and Transport and Highways.

Dean
Professor P. T. Fink

Chairman
Professor N. L. Svensson

Administrative Officer
Patricia Rathbun Robertson, BA *Maryland*

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

Professor of Civil Engineering and Head of Department of Structural Engineering
Robert Falcon Warner, ME *N.S.W.*, PhD *Lehigh*, MIEAust, MASCE

Professor of Civil Engineering and Head of Department of Water Engineering
Harold Rupert Vallentine, BE *Syd.*, MS *Iowa*, ASTC, FIEAust

Visiting Professor of Civil Engineering
*James Macquarie Antill, BE *Syd.*, ME *N.S.W.*, FIEAust, FIArb(Lond), FIArb(Aust), AMAusIMM

Professor of Engineering (on secondment)
†Thomas Kevin Hogan, BE *W.Aust.*, FIEAust, MAusIMM

*Retired from the University, 1 December 1977.
†Retired from the University, 31 December 1977.

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

Executive Assistant to Head of School

Peter Stephen Balint, DipIEng *Bud.*, ME *N.S.W.*, MIEAust

Administrative Officer

Robert William Prior

Department of Civil Engineering Materials

Includes Soil Mechanics, Rock Mechanics, Concrete Technology, Plastics and Timber, Pavement Engineering, Continuum and Statistical/Mechanics.

Associate Professor and Acting Head of Department

Owen Graeme Ingles, BA MSc *Tas.*, CEng, FRIC, 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, MS *Cape T.* and *Camb.*, PhD *N.S.W.*, FIEAust MICE

David John Cook, BE *W.Aust.*, MSc PhD *Calg.*, MIEAust, AMASCE, APIA

Esca Morrice Kitchen, BE *Syd.*, MIEAust

Bruce John Francis Patten, BE *Syd.*, PhD *N.S.W.*, DIC

William Otho Yandell, ME PhD *N.S.W.*, MIEAust

Lecturers

Stephen John Hain, BE *Syd.*

Arthur William Manton-Hall, BE MEngSc *N.S.W.*, MIEAust

Harry Taylor, BSc(Eng) *Birm.*, DipNA&AC *Syd.*

John Maurice Wheatley, MA PhD *Camb.*, FIM, FAusWI, MAusIMM, MWeld(Lond), AFAIM

Weeks White, BSc BE *Syd.*, MIEAust

Stephen Ross Yeomans, BSc PhD *N.S.W.*, GradIMAust

Teaching Fellow

Keiichi Matsuzaki, ME *Tokyo*

Professional Officers

David Edwin Hattersley, MSc *N.S.W.*, ASTC

Heinrich Nicolaus Lunsmann, BE *N.S.W.*, ASTC, GradIEAust

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.*, MIEAust

Lecturers

Graham Rush Easton, BSc BE *Syd.*, MEngSc *Birm.*

Jonathan Brian O'Brien, BE *N.S.W.*, MASc *Tor.*, MIEAust

Victor John Summersby, BE MEngSc *N.S.W.*, ASTC, MIEAust

Stephen Joseph Symonds, BSc BE MTCP *Syd.*, MEngSc *N.S.W.*, MIEAust

Tutor

George Charles Birdsall, BE *N.S.W.*, GradIEAust

Professional Officers

Eleanor Ruth Langley, BA *Syd.*, MACS

Frederick Adrian John Stein, ED, BE *N.S.W.*, GradIEAust, AMASCE

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, DipIEng *Bud.*, ME *N.S.W.*, MIEAust

Algis Kabaila, MEngSc PhD *N.S.W.*, FRMTC, MIEAust, MASCE

Rupert Whitfield Traill-Nash, BE *W.Aust.*, PhD *Brist.*, CEng, MIEAust, MRAeC

Senior Lecturers

Peter Stephen Balint, DiplEng *Bud.*, ME *N.S.W.*, MIEAust

Lloyd Sydney Edwards, BCE *Melb.*, BEc *Syd.*, MSc *Lond.*, DIC, ARMTC, MIEAust

Donald John Fraser, MEngSc PhD *N.S.W.*, ASTC

Jack Lachlan Jenkins, BE *Syd.*, ME *N.S.W.*, DIC, ASTC, MIEAust

Victor Andrada Pulmano, BSCE *Philippines,* MEng *A.I.T.* PhD *Northwestern*

B. Vijaya Rangan, BE *Madr.*, PhD *I.I.S.B'lore.*, MASCE, MIEAust

Ian James Somervaille, BE PhD *N.S.W.*, ASTC

Lecturers

Alex Cuthbert Heaney, BE MEngSc *Melb.*, PhD *Wat.*, MIEAust, MASCE, AMICE

Peter Walder Kneen, BE *Melb.*, PhD *Wat.*, MIEAust

Raymond Eric Lawther, BE PhD *N.S.W.*

Teaching Fellows

Henry Edward Ah Cann, BE *N.S.W.*

Maria Attard, BE *N.S.W.*

Robert John Edwardes, BScEng *N.S.W.*

Raymond Ian Gilbert, BE *N.S.W.*

Russell Forester Staley, BSc *Leeds*

Professional Officers

Kim Small, BSc *Syd.*

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 Professors

Douglas Neil Foster, BE *Syd.*, MIEAust

Bernard William Gould, BE *Tas.*, ME *N.S.W.*, MIEAust

David Herbert Pilgrim, BE PhD *N.S.W.*, MIEAust

Keith Kingsford Watson, BE *Syd.*, ME PhD DSc *N.S.W.*, MIEAust

Senior Lecturers

Ian Cordery, ME PhD *N.S.W.*, MIEAust

Colin Raymond Dudgeon, ME *N.S.W.*, MIEAust, MASCE

Trevor Regis Fietz, ME *N.S.W.*, MIEAust

David Trewhella Howell, BE *Syd.*, ME *N.S.W.*, MIEAust, MAIAS

John Robert Learmonth, BE *Syd.*, ME *N.S.W.*

Lecturers

David Barnes, BSc PhD *Birm.*, MIWSE, AMICE

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

David Lyon Wilkinson, BE *Syd.*, PhD *N.S.W.*, MIEAust

Tutor

Joseph Kitugar Seeto, BE MEngSc *N.S.W.*, GradIEAust

Teaching Fellow

Peter Howard Bloomfield, BE *N.S.W.*

Professional Officers

David George Doran, BE DipCompSc *Qld.*, MEngSc *N.S.W.*

Jonathan Keith Tuck, BE *N.S.W.*

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, MIEE

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, BSc *Syd.*, DPhil *Oxon.*, 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
Mollie Lenthall, BA *Syd.*

Senior Tutor
Geoffrey Nicholas Horton Westley, BEng *Liv.*, MIEEE

Tutors
Branko George Celler, BSc BE *N.S.W.*
Brian Louis Cohen, BSc *N.S.W.*
Eric Gauja, BSc BE *N.S.W.*
Gregory Charles Hurst, BSc BE *N.S.W.*
Graham Reginald Hellestrand, BSc *N.S.W.*
Dorothy Ping Seng Lee, BSc BE MEngSc *N.S.W.*
Phillip George McCrea, BE PhD *N.S.W.*

Teaching Fellows
Peter Garde, BE MEngSc *Monash*
Sui Cheong Albert Poon, BE *N'cle.(N.S.W.)*, HDip *H.K.Poly*

Professional Officer
Jeffrey Stanley Skebe, BS *Case W.R.*

Department of Communications

Associate Professor
Warwick Harvey Holmes, BSc BE MEngSc *Syd.*, PhD *Camb.*, MIEEE, MIREE

Senior Lecturers
Edward Henry Fooks, BSc PhD *Lond.*, CEng, MIEE, MIEEE
Thomas Leslie Hooper, BSc *Syd.*, MSc *N.S.W.*, CEng, MIEE, MIEEE, MIREE
Geoffrey John Parker, BSc BE *Syd.*, ME *N.S.W.*, MIEAust, MIREE
Christopher John Elliot Phillips, BSc BE PhD *Syd.*, MIEE, MIEEE, MIREE
The Bao Vu, Be PhD *Adel.*
Ramutis Anthony Zakarevicius, BSc BE MEngSc PhD *Syd.*, MIEAust, MIEEE, MIREE

Lecturers
Pak Lim Chu, ME PhD *N.S.W.*, MIREE
William John Dewar, MSc(Eng), *Qu.*, PhD *N.S.W.*
Harold Leslie Humphries, BSc BE BEc *Syd.*, MIEAust, MIREE
Robert Radzyner, BE *Melb.*, MEngSc PhD *N.S.W.*, MIEEE

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

Senior Lecturers
Alan Dunworth, BSc PhD *Manc.*, SMIEEE, FIREE
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.*
Ian James Hayes, BSc *N.S.W.*
Leslie Charles Hill, BE *N.S.W.*, MIEAust
Kenneth Arthur Robinson, BSc BE *Syd.*

Professional Officers
Serge Poplavsky, Dipling *Bratislava*, ME *N.S.W.*
Keith William Titmuss, BSc(Tech) *N.S.W.*

Department of Electric Power Engineering

Associate Professors
Garth Claud Dewsnap, MEE *Melb.*, CEng, FIEE, MIEAust
Gordon William Donaldson, BE *Old.*, BSc MA *Oxf.*, CEng, MIEE, MIEAust
Gregory Joseph Johnson, MSc *Syd.*, SMIEEE, CEng, MIEE, AInstP, AAIP
Ian Francis Morrison, BSc BE PhD *Syd.*, CEng, MIEAust, MIEEE, MIEE

Senior Lecturers
Harry Harrison, BSc BE *Syd.*, ME *N.S.W.*, MIEAust
Ronald Edward James, BSc(Eng) PhD *Lond.*, CEng, MIEE, MIMechE

Lecturers
Trevor Robert Blackburn, BSc *Adel.*, PhD *Flin.*, GAIP
Cyriacus Adrianas Bleys, BSc *Adel.*, DipElectrotechnique Dring *Paris*
David Bruce Goudie, BSc BE PhD *Syd.*, MIEEE, AMIEE
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
Richard Vaughan, BSc BE PhD *Syd.*

Lecturers
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

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, MIEEE
Colin Arthur Stapleton, BSc BE *Syd.*, CEng, MIEE, MIEEE, MIEAust
Keith Eugene Tait, BE(Hons) BSc *N.Z.*, PhD *N.S.W.*, MIEAust

Senior Lecturers
Peter Thomas Bason, ME *N.S.W.*, MIEEE, MIREE
Reginald Frederick Brown, BEng *Liv.*, PhD *N.S.W.*, CEng, MIEE
David Harold Mee, BSc BE *Syd.*, PhD *Lond.*, DIC, MIREE
Darrell Williamson, BSc ME *N'cle.(N.S.W.)*, PhD *Harv.*

Lecturers
Kevin Charles Daly, BSc BE PhD *N.S.W.*
Felix Lewin, BSc BE *Syd.*
Oleg Pawloff, Dipling *Berl.*, MIEAust, MIREE

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

Nuffield Professor of Mechanical Engineering, Head of School and of Department of Fluid Mechanics/Thermodynamics
Raymond Alfred Arthur Bryant, ME *N.S.W.*, ASTC, CEng, FIMechE, FIEAust, MRAeS

Professor of Mechanical Engineering
Peter Thomas Fink, BE *Syd.*, CEng, FTS, FIEAust, FIMechE, FRAeS, FRINA, MAIAA

Sir James Kirby Professor of Production Engineering and Head of Department of Industrial Engineering
Peter Louis Brennan Oxley, BSc PhD *Leeds*, CEng, FIProdE, FIEAust, MIMechE

Professor of Operations Research
George Bennett, BA *Syd.*, PhD *N.S.W.*, ASTC, CEng, FIProdE

Professor of Mechanical Engineering and Head of Department of Applied Mechanics
Noel Levin Svensson, MMechE PhD *Melb.*, CEng, FIEAust, MIMechE, AMIM, MSESA

Professor of Mechanical Engineering and Head of Department of Agricultural Engineering
Albert Henry Willis, DSc(Eng) *Lond.*, CEng, FIMechE, FIEAust, MemASAE, WhSc

Executive Assistant to Head of School
John Young Harrison, BE *Syd.*, PhD *N.S.W.*, MIEAust

Senior Administrative Officer
George Dusan, BEc *Syd.*

Honorary Associate
Cyril Arthur Gladman, BSc(Eng) *Lond.*, ACGI, CEng, FIProdE, MIMechE, MIED

Tutors
David Malcolm Jenkins, BE *Syd.*
Robert William Widders, BE *Syd.*
Hoong Gheow Wong, BE *N.S.W.*

Teaching Fellows

Hok Fung Cheung, BE *N.S.W.*

William Ernest Fisher, BSc BE *Syd.*

See Seng Leong, BE *N.S.W.*

Lyle John McLean, BSc(Eng) *N.S.W.*, GradIEAust

Nan Hung Pan, BE *N.S.W.*

Hadi Winarto, BE *Syd.*, MEngSc *N.S.W.*, GradIEAust

Professional Officers

Han Bao, BE MEngSc PhD *N.S.W.*

Eric Arthur Carter, BE MEngSc *N.S.W.*, ASTC

Walter Dollar, ASTC

Richard Butler Frost, BE *N.S.W.*, GradIEAust

Joseph Yuk Ming Fung, BE MEngSc *Syd.*, GradIEAust

Khoi Hoang, BE *Saigon*

Brian Robert Edgar Lederer, BSc *N.S.W.*, PhD *Syd.*

Barrie Clifford Motson, BE *N.S.W.*, ASTC, MIEAust

Philip Henry Sivyer, BE *N.S.W.*, 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, MIAgrE, MemASAE

Department of Applied Mechanics

Associate Professor

John Young Harrison, BE *Syd.*, PhD *N.S.W.*, MIEAust

Senior Lecturers

Jacob Alexander Bruce Cartmel, MSc *Cran.I.T.*, PhD *N.S.W.* CEng, FIMechE, FIEAust, MASME, MIEEE

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

Lecturers

John Edward Baker, MSc *Syd.*, BE MEngSc PhD *N.S.W.*

Kerry Patrick Byrne, BE MEngSc *Qld.*, BSc *Melb.*, PhD *S'ton*

Raymond Albert Vincent Byron, BE *Syd.*, CEng, MRAeS, MAIAA

George Crawford, BE BSc *N.S.W.*, ASTC, CEng, FIEAust, ARACI

Ronald Arthur Dennis, MSc *Nott.*, CEng, MIMechE

Robin Arthur Julian Ford, BSc(Eng) PhD *Lond.*, ACGI

Knut Kjorrefjord, BSc *Durh.*, CEng

Farrokh Mistree, BTech *I.I.T. Kharagpur*, MS PhD *Calif.*

Donald Jabez Stephen Mudge, BSc *Lond.*, CEng, MIMechE, MIEAust, WhSc

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

Reginald Edward Corbett, DIC, ASTC, CEng, MIMechE, MIEAust

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 *Oxon.*, 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

Charles Matthew Sapsford, BSc(Eng) *Lond.*, ME *N.S.W.*, CEng, FIMechE, MIEAust

Lecturers

Francis Grindal Bartlett, MSc *Mich.*

Graham Lindsay Morrison, BE PhD *Melb.*

John Arthur Reizes, ME PhD *N.S.W.*, MIEAust

Department of Industrial Engineering

Includes Operations Research and Production Engineering.

Associate Professors

Michael Geoffrey Stevenson, BSc(Tech) PhD *N.S.W.*, ASTC, CEng, MIEAust, MIProdE

Jack Taylor, BSc *Nott.*, CEng, FIMechE

Senior Lecturers

John Frederick Campbell Close, BSc BE *Syd.*, ME *N.S.W.*, MIEE, SMAIIE, MIEAust

Bruce Albert Murtagh, ME *Cant.*, PhD *Lond.*, DIC, CEng, MIChemE

Raymond Norman Roth, BE PhD *N.S.W.*, CEng, MIEAust

Graham Smith, BE MEngSc PhD *N.S.W.*, ASTC, MIEAust

Lecturers

Leonard Edward Farmer, BE MEngSc PhD *N.S.W.*, MIEAust

Daniel Goodridge, DiplIngChim *L'Aurore, Shanghai*, DiplndEng *N.S.W.*

Thomas Richard Jefferson, MSc *Tor.*, PhD *Northwestern*

Grier Cheng Lin, DipMechEng *P.T.I.T., Taiwan*, PhD *N.S.W.*, MIEAust

Carlton Henry Scott, BSc *Qld.*, PhD *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, Dipling *Prague*, MSc *Birm.*, MEngSc PhD *N.S.W.*, MIEAust

Senior Lecturer

Leslie George Kemeny, BE *Syd.*, MIEAust

Lecturer

Olaf Oscar Carlos Alexander Bils, Dipling *Berl.*, PhD *N.S.W.*

Teaching Fellow

Peter Thomas Bath, BE MEngSc *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

Administrative Assistant

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

Associate Professor

Ronald Sunthereraj Mather, BSc *Ceyl.*, PhD DSc *N.S.W.*, FISAust

Senior Lecturer

Arthur Stolz, BSurv PhD *N.S.W.*, RegSurv(NSW), MISAust

Lecturers

Friedrich Karl Brunner, Dipling Dr techn *T.H. Vienna*, MISAust

Arthur Harry William Kearsley, BSurv MSurvSc PhD *N.S.W.*, MAIC, MISAust

Department of Photogrammetry

Includes Land Studies and Cartography.

Associate Professor

John Charles Trinder, BSurv PhD *N.S.W.*, MSc *T.H. Delft*, RegSurv(NSW), MISAust

Senior Lecturers

Bruce Crosby Forster, MSurv *Melb.*, MSc *R'dg.*, MAS *P.N.G.*, LS(Vic)

George James Forster Holden, DipPhoto *Lond.*, PhD *N.S.W.*, FRGS, MISAust, MAIC, ARICS

Lecturers

Pratap Shivabhai Amin, BSc *T.H. Delft*, MSc *Lond.*, MISAust, MISK, CLSEA, ARICS

Leonard Berlin, BSc(LS) *Cape T.*, BSc *T.H. Delft.*, MISAust

Ian Philip Williamson, BSurv MSurvSc *N.S.W.*, RegSurv(NSW), MISAust

Senior Tutor

Salvatore Umberto Nasca, DottScGeol *Florence*, DipTop&Cart *(Istituto Geografico Militare)*, MGAS, AMAIMM

Department of Surveying

Associate Professor

John Stuart Allman, BSurv PhD *N.S.W.*, MISAust, MAIC

Senior Lecturers

Anthony John Robinson, BSurv PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC

Arthur Paul Heinz Werner, Dipling *Bonn*, FISAust

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

John Richard Pollard, BSc *Qld.*, BTech *S.A.I.T.*

Jean Marc Rueger, Dipling *E.T.H. Zurich*, SIA, LS(Switz), MISAust

Senior Tutor

Robert Campbell Patterson, BSurv BSc MSurvSc *N.S.W.*

Tutors

Paul Charles Covell, BSurv *N.S.W.*

Thomas Sinclair Morrison, BSurv *N.S.W.*

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

Theo ten Brummelaar, BE MEngSc *N.S.W.*, MIEAust

Alex James Fisher, BSc *Lond.*, PhD *N.S.W.*

Robert Alexander Jones, BE *W.Aust.*, ME *Auck.*, MSc *Lond.*, DIC, MSINZ, MIEAust

Ross Donald Munro, BSc *W.Aust.*, BA *Melb.*, FSS

Brian Shackel, BE *Sheff.*, MEngSc PhD *N.S.W.*, MIEAust, MASCE

John Irwin Tindall, BE *Qld.*, BCom ME *N.S.W.*, AMIEAust

Lecturers

John Andrew Black, BA *Manc.*, PhD *Brad.*, AMIT

Michael Clarence Dunne, BSc PhD *Adel.*

Professional Officers

Roger Roy Hall, BSc *A.N.U.*, MSc *N.S.W.*

Clement Edward Quinlan, GradDip *N.S.W.*, ASTC, MIEAust

Andrzej Waldemar Raczkowski, Mgrlnz *T.U. Warsaw*

Colin John Wingrove, BSc MEngSc *N.S.W.*

Broken Hill Division

Staff

Director
Professor J. E. Andersen

W.S. and L.B. Robinson University College

Director and 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

Administrative Officer
Peter Francis Hern, AASA

Professional Officer
Boyd Parker Watson, BSc(Tech) *N.S.W.*

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.*, BE *B'lore*, PhD *Monash*, MIEAust

Mining Engineering

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, AMAusIMM

Lecturers
Ian Rutherford Plimer, BSc *N.S.W.*, PhD *Macq.*, AMAusIMM, AMIMM
Kevin David Tuckwell, BSc PhD *N.S.W.*, AMAusIMM

Tutor
Alaster Carlile Edwards, BSc *Melb.*, GSA, AMAusIMM

Department of Science

Chemistry

Associate Professor
Keith George O'Brien, MSc *Syd.*, PhD *N.S.W.*, FRACI, AMAusIMM

Lecturer
Derek Richard Smith, BSc PhD *Wales*

Senior Tutor
Robert Edward Byrne, MSc *N.S.W.*, ARACI, AMAusIMM

Mathematics

Lecturers
David Charles Guiney, BSc PhD *Adel.*
Zdenek Kviz, Dip Phys *Brno*, CSc RerNatDr *Charles*, PhD *Prague*
Dennis William Trenerry, BSc PhD *Adel.*

Physics

Senior Lecturer
Robert John Stening, MSc *Syd.*, PhD *Qld.*, MAIP

Lecturers
Kenneth Reid Vost, BSc *Glas.*, MSc *N.S.W.*, AMAusIMM

Fowlers Gap Research Station

Officer-in-Charge
Ian Hugh Auldist, BAgSc *Melb.*, MAIAS

Faculty Information

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1978 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1978* 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.

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.

Centre for Biomedical Engineering

The Centre was established in 1976 to provide a focus for interdisciplinary studies and developments in engineering, medicine and the biological sciences. Various projects are being helped by the Centre in specific ways, and in general terms the Centre provides a link between Hospital and University personnel and facilities.

An Advisory Board, appointed by the Vice Chancellor, and consisting of eminent people from many diverse areas of expertise, is responsible for overall policy-making. A Management Committee, whose members are drawn from the disciplines of mechanical, electrical and chemical engineering, preclinical sciences, orthopaedics, cardiology and the medical electronics industry, guides the execution of policy objectives and the general activities of the Centre. Ad hoc Project Committees look after the progress of specific projects.

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, 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 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 at 65 York 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.

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.

Donor	Value	Year/s of Tenure	Conditions
General			
Bursary Endowment Board*	$300 pa if living at home; $400 pa if living away from home	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding $4000.

Undergraduate Scholarships (continued)

General (continued)

Donor	Value	Year/s of Tenure	Conditions
Sam Cracknell Memorial	Up to $1500 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.
Air Force Association Memorial Scholarship	$250 pa	1 year renewable for the duration of the course subject to satisfactory progress	Child of member or former member of Royal Australian Air Force undertaking a full-time degree course.
Girls' Realm Guild Scholarship	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	$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	$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	$300 pa	1 year	
Surveying			
The Institution of Surveyors, NSW Division	$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

Applications for scholarships should be made in triplicate on the required form, and sent to the Registrar by 31 October. Eligibility depends on such factors as the applicant holding an honours degree *or* equivalent qualification, *or* having relevant experience. Students completing the final year of a course may apply. Those under bond should disclose this fact. Awards are tenable for one year, and may be renewed for a maximum of two years for a Masters and 3 to 4 years for a PhD degree. Renewal each year is subject to satisfactory progress. Any exceptions from these requirements are indicated.

Application forms and further information are available from the Student Employment and Scholarships Unit, which is located on the ground floor of the Chancellery. This Unit produces the booklet *Graduate Awards*, and also 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 schools within the faculty.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Research Awards		1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates (or equivalent).
Commonwealth Government (Research Awards)	Living allowance of $4200 pa. Other allowances may also be paid	As above	Applicants must be honours graduates (or equivalent) or scholars who will graduate with honours in current academic year, and who are domiciled in Australia.
Commonwealth Government (Course Awards)		1-2 years; minimum duration of course	Applicants must be graduates or scholars who will graduate in current academic year, and who have not previously held an Australian Government Postgraduate Award. Applications to Registrar by 30 September.
Australian American Educational Foundation Travel Grant*			Applicants must be graduates, senior scholars or post-doctoral Fellows. Graduate applications close 31 December. Other applications by mid-November.
Australian Federation of University Women	A total of $500-$3200	Up to 1 year	Applicants must be female graduates from any accredited Australian or overseas university.
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 by 28 February for visits to commence during ensuing 1 April to 31 March.

*Application forms are available from: The Secretary, Department of Education, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Caltex Woman Graduate of the Year Scholarship	$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.
Canadian Pacific Airlines Award for Travel to Canada for University Graduates	One free economy class return flight a year to Canada		Graduates of an Australian University who are Australian citizens or permanent residents. Candidates must have been accepted by a Canadian University, be able to support themselves on a full-time basis, and intend to return to Australia. Applications close with Registrar by 31 May.
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	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.
General Motors Holden's Research Fellowship	Living allowance and other allowances	Maximum of 3 years	Graduates qualified to undertake research program for Masters or PhD degree.
Gowrie Graduate Research Travelling Scholarship	Maximum $2000 pa	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War.
Harkness Fellowships of the Commonwealth Fund of New York*	Living and travel allowances, tuition and research expenses, book and equipment and other allowances	Between 12 to 21 months	Candidates must be either: **1.** Members of the Commonwealth 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 and be between 21-30 years of age. Applications close 23 July.
IBM Graduate Scholarship Plan	A maximum of $1200 pa	A maximum of 2 years for a degree of Master and 4 years for a PhD	Graduates must already hold a scholarship, such as an Australian Government Postgraduate Research Award and be studying computer science or its applications. Applications close with Registrar by 30 November.

*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.

Graduate Scholarships (continued)

General (continued)

Donor	Value	Year/s of Tenure	Conditions
Frank Knox Memorial Fellowships at Harvard University	Stipend of $3400 plus tuition fees pa	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**	£3000 stg pa	2 years, may be extended for a third year	Unmarried male and female British subjects, 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‡	$12000 pa	Up to 3 years	The field of study is unrestricted. Applications close early September each year.

**Applications to Mr H. McCredie, Secretary of the NSW Committee, University of Sydney, NSW 2006.

‡Applications to The Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.

†Applications to the Secretary, The Nuffield Foundation Australian Advisory Committee, Chemistry Laboratory, Barry Building, University of Melbourne, Parkville, Victoria 3052.

Engineering

Harold G. Conde Memorial Fellowship	$4500	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.
Mobil Fellowship in Highway Engineering	$4000 pa plus allowances	1 year	The successful candidate will undertake the degree of Master of Engineering Science in Highway Engineering. Further information: Professor W. R. Blunden, School of Transport and Highways, UNSW or Public Relations Officer, Mobil Oil Pty Ltd, ADC Building, 189 Kent Street, Sydney 2000.
University Fellowships in Highway Engineering		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.

Graduate Scholarships (continued)

Engineering (continued)

Donor	Value	Year/s of Tenure	Conditions
Australian Institute of Nuclear Science and Engineering Studentships	Single students $4420 pa. Dependent spouse allowance $1508 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†	$11000-$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	£1750 stg pa plus travelling expenses	2 years	Applicants must be unmarried, male, British subjects, 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	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

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
Faculty of Engineering		
The Dean's Faculty Hour	25.00	Best essay by a graduating student on a topic discussed in Faculty Hour
	25.00	Best essay by a nongraduating student on a topic discussed in Faculty Hour
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 (Textile Engineering option only)
The John Fraser Memorial Award	Advised annually	Excellence in the first year or equivalent part-time years of a bachelor's degree course offered by the Faculty of Engineering
School of Civil Engineering		
The Association of Consulting Structural Engineers of New South Wales	20.00 and books to the value of 30.00	General proficiency — Structures in the Bachelor of Engineering Course in Civil Engineering
	20.00 and books to the value of 30.00	General proficiency — Structures in the Bachelor of Science (Engineering) Course in Civil Engineering
Australian Welding Institute	30.00	Best design using a welding process for students in Years 2, 3 or 4
BMI Ltd Systems Engineering	50.00	8.301 Systems Engineering
Chamber of Manufactures of New South Wales	15.00	Subject selected by Head of School
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 Corp of Australia Ltd Prize	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
Hornibrook	100.00	Proficiency in Engineering Construction and Management
Water Board Gold Medal	Medal	Public Health Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Electrical Engineering		
Austral Bronze Crane Copper Ltd	25.00	Bachelor of Engineering Course in Electrical Engineering, Year III
	25.00	Power or Control elective
Chamber of Manufactures of New South Wales	15.00	Subject selected by Head of School
Electricity Supply Engineers Association of New South Wales	40.00	Third year full-time or equivalent part-time students for overall performance including proficiency in Electric Power Distribution
J. Douglas Maclurcan	30.00	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
Austral Crane Ltd	50.00	Full-time Year III Mechanical Engineering
Babcock & Wilcox Aust Ltd	21.00	Subject selected by Head of School
Chamber of Manufactures of New South Wales	15.00	Subject selected by Head of School
CSR Limited	50.00	Subject selected by Head of School
Ford Motor Co of Aust Ltd	20.00	Subject selected by Head of School
Harbin Polytechnical Alumni Association	50.00	5.113 Mechanical Engineering Design III
Jeremy Hirschhorn	20.00	Theory of Machines
Royal Institution of Naval Architects	30.00	Bachelor of Engineering or Bachelor of Science (Engineering) 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 Ltd	80.00	Bachelor of Engineering Course in Industrial Engineering, Year III
Chamber of Manufactures of New South Wales	15.00	Subject selected by Head of School
Industrial Engineering	25.00	Performance in Year 2 of Bachelor of Engineering degree course in Industrial Engineering
R. E. Jefferies Memorial	100.00	Performance in final year/stage of bachelors degree course in Industrial Engineering
TRW Australia Ltd	20.00	Bachelor of Science (Engineering) Course in Industrial Engineering, Stage 6

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Surveying		
Board of Surveyors Medal	Medal	Bachelor of Surveying Course, Final Year

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

General		
The Thistlethwayte Memorial Prize	100.00	Best essay in the field of water — waste water treatment or water quality management, by MEngSc, MAppSc, ME, MSc student
School of Transport and Highways		
Veteran Motorists of Australia	20.00	Traffic Planning and Control
Wabco Aust Pty Ltd	300.00	Most distinguished graduate in Highway Engineering course leading to MEngSc degree

Undergraduate Study

Undergraduate Courses

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, part-time and sandwich course leading to the degree of Bachelor of Surveying. The Schools of Nuclear Engineering and Transport and Highways offer graduate courses only.

All the graduate activities of the Faculty are co-ordinated under the Graduate School of Engineering. For full details of such activities please see the Graduate School of Engineering Handbook and the University Calendar, or contact the appropriate school.

Common First Year

The Schools of Civil, and Mechanical and Industrial Engineering have similar first year courses in physics, mathematics and chemistry, facilitating the transfer of students from one Bachelor of Engineering course to another within these schools at the end of their first year without loss of standing.

The first year courses in the Schools of Electrical Engineering and Surveying differ from the courses offered by the Schools of Civil Engineering and Mechanical and Industrial Engineering. However, notwithstanding the fact that the courses are not identical, sympathetic consideration will be given to requests by students who have completed first year to transfer to an allied course without loss of standing. When such transfer is desired an application must be made with the Registrar.

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 first-year students to pass in at least half the program in which they are enrolled. 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 corequisite 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.

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. In nearly all cases substantial or complete recognition is accorded to these courses by overseas engineering institutions.

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

Since 1961 the Schools of the Faculty have offered six-year part-time courses in a variety of engineering fields leading to the degree of Bachelor of Science (Technology). From 1971 the name of this degree became Bachelor of Science (Engineering) but is not awarded retrospectively. Courses for the BSc(Eng) degree are offered in Civil, Electrical, Industrial and Mechanical Engineering and in Naval Architecture and Aeronautical Engineering (these two being offered by the School of Mechanical and Industrial Engineering). No enrolments are now accepted for the BSc(Eng) course in Civil Engineering; the last initial enrolment year was 1974.

The General Studies program is the same for part-time as for full-time students, except that part-time students do not do an Advanced Elective.

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 of Engineers, Australia.

Recognition by overseas engineering institutions varies in the different branches of engineering, and particular 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.

The School of Surveying offers a part-time course of seven years' duration for the degree of Bachelor of Surveying. The existing part-time course is being phased out over the period 1975-1980, and replaced by a sandwich course.

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 follow an approved course of study in this University for at least two years.

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 Award of 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;

(3) complete an approved program of industrial training for such periods as prescribed. In general this training should be completed before the commencement of Part 8 of the undergraduate studies;

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, 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

Undergraduate Study

Course Outlines

School of Civil Engineering

The School of Civil Engineering offers two degree courses in Civil Engineering: the Bachelor of Engineering (BE) course 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; and the Bachelor of Science (Engineering) (BSc(Eng)) course which is a part-time program, comprising the first six stages of the 7-stage Bachelor of Engineering course. No enrolments are now accepted for the BSc(Eng) course in Civil Engineering; the last initial enrolment year was 1974.

The requirements for the BE degree include a period of at least sixty working days of approved industrial experience prior to enrolment in the final year; the requirements for the BSc(Eng) degree include a period of at least three years of suitable engineering experience concurrent with the university course.

A student who has completed the requirements for the award of the BSc(Eng) degree in Civil Engineering but has not taken out the degree by formal graduation may apply to the Head of School for enrolment on a part-time basis in the BE degree course.

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. The degree of Bachelor of Science (Engineering) may be awarded with Merit in recognition of superior performance throughout the course.

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Double Degree BSc BE in Civil Engineering

Students may seek permission to undertake a course* leading to a combined degree of Bachelor of Science and Bachelor of Engineering (BSc BE). The course is of five years' duration and comprises the main strands of Civil Engineering course together with a major in any of a number of the subjects offered in the Faculty of Science.

*At time of publication, details have yet to be approved.

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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

For footnotes, see overleaf, column one

*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 together with 2.981 Chemistry ICE students will be exempted from one technical elective.

†Students who have not satisfied the science prerequisite for 1.981 Physics ICE (ie 2 or 4 unit Science including Physics or Chemistry at Grades 1, 2 or 3) are advised to apply to enrol in two acceptable alternative subjects, 2.111 Introductory Chemistry and 2.121 Chemistry IA.

**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†	—	—
	Two Electives***	3	3
		22½	24½

***See this footnote below Stage 4.

†Students are required to attend a one-week Survey Camp, equivalent to 40 class contact hours.

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 this footnote below Stage 4.

Year 4

8.001	Industrial Training	—	—
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 this footnote below Stage 4.

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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*	6	6
	One Elective***	0	3
		12	15

*Students attending in the daytime may attempt alternative subjects. See the footnote following year 1.

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.

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†	—	—
		14	12

**42 hours of Saturday fieldwork is an essential part of this subject.

†Students are required to attend a one-week Survey Camp, equivalent to 40 class contact hours.

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
	One Elective***	3	0
		13½	10½

***Of ten required electives 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.

Footnote continued on next page, column one

In order to satisfy the elective requirements students may take an elective in Session 2 of Stage 4.
Approved technical electives for Year 2 are 6.851 Electronics and Instrumentation, 6.832 Industrial Electrical Machinery, 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 8.018 Construction Engineering, 8.021 Environmental Aspects of Civil Engineering, 8.023 Hydrodynamics, 8.026 Systems Methods in Civil Engineering, 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, 8.015 Road 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, 8.028 New Materials II, 8.030 Construction Management, 8.031 Construction Project Finance, 8.032 Law for Builders, 8.033 Industrial Law and Arbitration, 8.034 Engineering Economy, 8.038 Special Topics in Reinforced Concrete, 8.039 Computer Programming, 8.042 Water Resources, 8.043 Public Health Engineering, 8.046 Town Planning, 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.

Stage 5

		Hours Per Week 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

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

Stage 7

8.001	Industrial Training	—	—
8.051	Design Project — Materials	1¼	0
8.052	Design Project — Structures	1¼	0
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
		14	12

School of Electrical Engineering

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

The School offers undergraduate and graduate training in all branches of the profession of electrical engineering: there are Departments of Communications, Computer Science, Electric Power, Solid State Electronics, and Systems and Control Engineering. A number of interdepartmental 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, the Institution of Radio and Electronics Engineers, Australia, and the Institution of Electrical Engineers, London, as giving complete exemption from the examinations required for admission, to Graduate or Corporate membership. The Institution of Engineers, Australia, is reviewing its requirements for graduates completing their course after June 1980.

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) 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 Scholarship Unit.

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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		
		24	24

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

**Available in either Session 1 or 2.

Year 2

1.972	Electromagnetism	0	4
1.982	Solid State Physics	4	0
1.992	Thermal Physics and Mechanics	2	2
	Electrical Engineering II		
6.021A	Basic Circuit Theory	4	0
6.021B	Power	0	4
6.021C	Electronics	0	4
6.021D	Introduction to Computing	4	0
6.021E	Digital Logic and Systems	4	0
6.022	EE Materials	0	4
10.111A	Pure Mathematics II (Linear Algebra)*	2	2
10.1113	Pure Mathematics II — Multivariable Calculus	2	0
10.1114	Pure Mathematics II — Complex Analysis	0	2
10.2111	Applied Mathematics II — Vector Calculus	2	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations	0	2
	One General Studies Elective	1½	1½
		25½	25½

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

Year 3

		Hpw S1	S2
3.302	Fuels and Energy†	0	4
5.661	Mechanical Engineering†	3	3
8.113	Civil Engineering†	4	0
10.033	EE Maths III	2	2
10.361	Statistics SE	2	2
	Electrical Engineering III		
6.0311	Systems and Feedback	4	0
6.0312	Utilization of Electric Energy	4	0
6.0313	Electronic Circuits I	4	0
6.0314	Signal Processing	0	4
6.0315	Electrical Energy	0	4
6.0316	Electronic Circuits II	0	4
6.0317	Communication Systems	0	4
	Two General Studies Electives	3	3

†Each student elects two of these three.

Year 4

6.911	Thesis*	2	21
	Electrical Engineering IV (6 electives)†	20	10
	and General Studies Elective	3	0
		25	31

*In Session 1 two hours per week and in Session 2 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 a written thesis must be submitted on each project by the penultimate Monday in November.

†*Electrical Engineering IV*
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 Circuits, Signals and Information Theory
6.044 Electrical Product Design and Reliability
6.202 Power Engineering Systems I
6.203 Power Engineering Systems II
6.212 Power Engineering—Utilization
6.222 High Voltage and High Current Technology
6.303 Communication Electronics
6.313 Wave Radiation and Guidance
6.322 Electronics
6.323 Signals in Communication Systems
6.333 Communication Systems
6.383 Biomedical Engineering
6.412 Automatic Control
6.413 Modern Systems Engineering
6.432 Computer Control and Instrumentation
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

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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	Basic Circuit Theory	0	4
10.1113	Pure Mathematics II — Multivariable Calculus	2	0
10.1114	Pure Mathematics II — Complex Analysis	0	2
		14	12

Stage 3

1.982	Solid State Physics	4	0
6.021B	Power	4	0
6.021C	Electronics	0	4
6.0311	Systems and Feedback	0	4
10.111A	Pure Mathematics II — Linear Algebra	2	2
10.2111	Applied Mathematics II — Vector Calculus	2	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations	0	2
	One General Studies Elective	1½	1½
		13½	13½

Stage 4 (from 1979)

1.972	Electromagnetism	0	4
1.992	Thermal Physics and Mechanics	2	2
6.021D	Computing	0	4
6.0313	Electronic Circuits I	0	4
6.022	EE Materials	4	0
6.0312	Utilization of Electric Energy	4	0
	One General Studies Elective	3	0
		13	14

Stage 5 (from 1979)

6.021E	Digital Logic and Systems	4	0
6.0314	Signal Processing	4	0
6.0315	Electrical Energy	0	4
6.0316	Electronic Circuits II	0	4
10.361	Statistics SE	4	0
6.0317	Communication Systems	0	4
		12	12

Stage 6 (from 1979)

	Three Professional Electives*	10	5
	One General Studies Elective	0	3
5.661	Mechanical Engineering	3	3
6.902	Industrial Experience	0	0
		13	11

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

Transition Arrangements into Revised Programs

Because the order of subjects has been rearranged, **Transition** programs operate for Stages 4 to 6 in 1978.

Stage 4 (1978 Only)

		Hpw S1	S2
6.0311	Systems and Feedback	0	4
10.2111	Applied Mathematics II — Vector Calculus	2	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations	0	2
1.972	Electromagnetism	0	4
1.992	Thermal Physics & Mechanics	4	0
6.021D	Computing†	0	(4)
6.0313	Electronic Circuits I	0	4
6.022	EE Materials†	(4)	0
6.0312	Utilization of Electric Energy	4	0
	One General Studies Elective	3	0
		13	14

†Not required for students who have otherwise completed Stage 4 by the end of 1978.

Stage 5 (1978 Only)

6.021E	Digital Logic and Systems	4	0
6.0314	Signal Processing	4	0
6.0315	Electrical Energy	0	4
6.0316	Electronic Circuits II	0	4
10.361	Statistics SE	2	2
6.0317	Communication Systems	0	4
	One General Studies Elective	3	0
		13	14

		Hpw S1	Hpw S2
Stage 6 (1978 Only)			
	Three Professional Electives*	10	5
	One General Studies Elective	0	3
	One of		
5.661	Mechanical Engineering	3	3
10.351	Statistics	2	2
6.620	Introduction to Computing Science	2½	2½
		12–13	10–11

By 1979 all students will be fully on the new program.

Course Revision

The school is engaged in an on-going program of course revision and detailed changes are being made from time to time.

It is a student's responsibility 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 student will lose credit for any subject completed, *and*
- no students will be liable for increased requirements if they progress normally.

Prerequisites and Co-requisites

Full-Time Bachelor of Engineering Degree Course 1978

Year	Subject	Prerequisites	Co-requisites
1	1.961, 2.121	See Matriculation and Admission Requirements	
	2.131	2.121	
	5.010	See Matriculation and Admission Requirements	
	5.030		
	6.010	The Electricity & Magnetism section of 1.961	
	10.001	See Matriculation and Admission Requirements	
2	1.972, 1.982, 1.992	1.961, 10.001	10.211A
	6.021A	1.961, 6.010, 10.001	
	6.021B	6.021A	6.021A (for BScEng)
	6.021C	1.982, 6.021A	
	6.021D	Computing strand of 5.030. If not, do 6.620	
	6.021E	10.001	
	10.111A	10.001	
	10.111B	10.001	
	10.211A	10.001	
	6.022	1.961, 2.121	
	6.620	10.001	
	6.641*	6.620 *or* 6.021D	
3	5.661	10.111B & 10.211A attempted, 1.992	
	10.033	10.111A, 10.111B, 10.211A	
	10.361	10.111A, 10.111B, 10.211A	
	6.0311	6.021A	10.111A & 10.111B desirable
	6.0314	6.0311	
	6.0312	6.021A, 6.021B	6.0311
	6.0315	6.0312	
	6.0313	6.021A, 6.021C	6.0311
	6.0316	6.0313	
	6.0317	6.0313	6.0314, 6.0316
4	6.041	6.0313	
	6.042	6.0314, 10.033, 10.361	
	6.044		
	6.202	6.0315	
	6.203	6.202 attempted	
	6.212	6.0315	6.322

Year	Subject	Prerequisites	Co-requisites
	6.222		
	6.303	6.0314, 6.0316, 6.0317	6.313 desirable
	6.313	6.0314	
	6.322	6.0314, 6.0316	
	6.323	6.0317	Working knowledge of elementary Fourier transforms and of elementary probability. 6.042 desirable
	6.333	6.0314, 6.0316	
	6.383	6.0314, 6.0316	
	6.412	6.0314	
	6.413	6.412	
	6.432	6.0311, 6.0316	
	6.512	6.0313	
	6.522	6.0316	
	6.612	6.021E *or* 6.602A	
	6.622	6.620 *or* 6.601A	
	6.911	(In graduating program only)	

*Students planning to transfer to Science 3 who wish to do 6.641 in 2nd Year must substitute this for 6.022, which they are then required to do in Year 3 of the BE degree course.

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 replaces; and

2. The resulting overall program of study is suited to the award of either the BE or BSc(Eng) 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 or Applied Mathematics in their Second Year Electrical Engineering program they open up a wider choice of subjects in their Science Third Year. Subjects omitted may be required to be taken in the student's Third Year of Electrical Engineering.

(4) The normal Fourth Year of the BE 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.

Double Degrees

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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 Science (this is subject to the recommendation of the Head of the School of Electrical Engineering and the approval of the Deans of the Faculties of Engineering and Science) and do the appropriate General Studies subjects and four level III units chosen from related disciplines and no less than four other units of either Level II or Level III chosen in accordance with the Science Course regulations.

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.

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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 364 in accordance with an acceptable program loading.

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

Table A*

10.001	Mathematics I	
10.111A	Pure Mathematics II (Linear Algebra)	
10.111B	Pure Mathematics II (Analysis)	
10.211A	Applied Mathematics II (Mathematical Methods)	
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

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.

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

The full-time courses of Mechanical, Industrial and Aeronautical Engineering and of Naval Architecture have common subjects for the first two years. The third and fourth years contain a number of common core subjects together with specific departmental requirements. In the fourth and final year, 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 offered by the School in lieu of an equivalent quantity of final year undergraduate electives. Each full-time 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 full-time 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, and irrespective of their specialization, are strongly recommended to gain as much industrial training as possible between Years 1 and 2.

The full-time courses in Aeronautical, Industrial and Mechanical Engineering and in Naval Architecture are of four years' duration and lead to the degree of Bachelor of Engineering (BE).

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. With the approval of the Head of School, students may proceed to the BE degree via a combination of full-time and part-time study.

Part-time courses of six years' duration leading to the degree of Bachelor of Science (Engineering) are offered in the same four fields as the full-time courses.

Part-time courses may also be completed by a combination of part-time and of full-time study. 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.

A student who has successfully completed the first two stages of any of the Bachelor of Science (Engineering) courses mentioned above may transfer to the second year of any of the full-time BE courses offered by the School. A part-time student will be able to transfer at the end of Stage 4 of his course to the third year of the corresponding BE course. The BSc(Eng) degree may be awarded 'With Merit' to students whose performance in the course is superior.

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.

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Mechanical Enginering — Full-time 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	*or* 6
5.030	Engineering C*	6	*or* 6
5.040	Engineering D	0	6
5.061	Technical Orientation	2	0
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I	6	6

Year 2

		Hpw S1		S2
5.032	Experimental Engineering II	2		2
5.111	Mechanical Engineering Design I	2		4
5.330	Engineering Dynamics*	4	*or*	4
5.611	Fluid Mechanics/Thermodynamics I	4		4
6.801	Electrical Engineering	3		3
5.411	Mechanics of Solids II*	4	*or*	4
8.259	Properties of Materials	3		3
10.022	Engineering Mathematics II	4		4
	General Studies Elective	1½		1½
18.061	Industrial Orientation	0		1

Year 3

5.033	Experimental Engineering III	1½		1½
5.043	Industrial Training I	—		—
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
5 512	Fluid Mechanics/Thermodynamics II	3½		3½
6.853	Analogue & Digital Instrumentation*	3	*or*	3
18.011	Industrial Engineering IA *or*	2		2
18.021	Industrial Engineering IB	2		2
	General Studies Elective	3		3

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 following technical electives:

4.913	Materials Science	3		3
5.113	Mechanical Engineering Design III	6		6
5.332	Dynamics of Machines II	3		3
5.413	Mechanics of Solids IV	3		3
5.614	Fluid Mechanics III	3		3
5.615	Thermodynamics III	3		3
8.026	Systems Methods in Civil Engineering	3		3
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

*One session only. Students will take this subject in either Session 1 or Session 2.

359
Mechanical Engineering — Part-time 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 / 1.011	Physics I *or* / Higher Physics I	6	6
10.001 / 10.011	Mathematics I *or* / Higher Mathematics I*	6	6

*Not available in the evening in 1978.

Stage 2

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

*One session only. Students take this subject in *either* Session 1 *or* Session 2.

Stage 3

5.311	Engineering Mechanics*	2½	*or*	2½
5.411	Mechanics of Solids II*	4	*or*	4
8.259	Properties of Materials	3		3
10.022	Engineering Mathematics II	4		4
	General Studies Elective	1½		1½

*One session only. Students take this subject in *either* Session 1 *or* Session 2.

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

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

		Hpw S1	S2
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		
5.332	Dynamics of Machines II	3	3
5.413	Mechanics of Solids IV		

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

361
Aeronautical Engineering — Full-time Course
Bachelor of Engineering
BE

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

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	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		2
18.021	Industrial Engineering IB	2		2
	General Studies Elective	3		3

*One session only. Students 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
5.801	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		
5.324	Automatic Control Engineering		
8.026	Systems Methods in Civil Engineering	3	3
18.022	Industrial Engineering IIB		
18.551	Operations Research		
		23½	23½

360
Aeronautical Engineering — Part-time 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 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 III	2	2
5.811	Aerodynamics I	3	3
5.822	Analysis of Aerospace Structures I	2	2
		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.

370
Naval Architecture — Full-time Course
Bachelor of Engineering
BE

The first and second years of this course are identical with the first two years of the full-time 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 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

5.033	Experimental Engineering III	1½	1½
5.043	Industrial Training I	—	—
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 IB	0	2
5.951	Hydrodynamics	1½	0
18.021	Industrial Engineering IB	2	2
	General Studies Elective	3	3
		22	22

Year 4

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

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Naval Architecture — Part-time 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 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	Ship 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 II	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 full-time and a part-time course in industrial engineering leading to the degree of Bachelor of Engineering and Bachelor of Science (Engineering) respectively. These courses are designed for students with engineering ability whose interests lie in the planning, developing and control of manufacturing or service operations.

The first two years of the full-time course and the first four years of the part-time course 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.

Traditional engineering courses do not embrace the problems which are characteristic of industrial engineering. These problems include the analysis of a product to ensure satisfactory functioning with regard to methods and sequence of manufacturing operations; the disposition of buildings and of equipment 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.

All full-time students must obtain approved industrial training for a period of forty working days between Years 2 and 3, also between Years 3 and 4. They are also strongly advised to obtain further experience during the long vacation between Years 1 and 2.

The Work of the Industrial Engineer

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

1. Industrial Economic Analysis

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

2. Planning and Control of Production

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

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Industrial Engineering — Full-time Course
Bachelor of Engineering
BE

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

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

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		
5.413	Mechanics of Solids II	3	3
8.026	Systems Methods in Civil Engineering		
		24½	24½

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Industrial Engineering — Part-time 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 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

Stage 5 continued at top of column 2

		Hpw S1	S2
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
		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 to School of Mechanical and Industrial Engineering.

School of Surveying

The School of Surveying offers a full-time course and a sandwich course leading to the Degree of Bachelor of Surveying. The full-time course is of four years' duration and is divided into eight parts of one session each. The sandwich course also consists of eight parts of one session each and may be completed in six or seven years. The old part-time course is being phased out and is being replaced by the sandwich course.

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 in recent years. Features of the revisions include: decreased lecture time to allow use of teaching methods which involve more student participation; an extended period of professional experience in the final year; Land Studies, a group of subjects designed to provide a broad understanding of the ecology of land and its development; and a survey camp of four weeks in the final year. 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.

Students intending to do the Sandwich Course are required to take Parts 1 and 2 of the Course *either* as full-time students for one year *or* as part-time students

over a period of two years. They will then switch to Part 3 of the Sandwich Course. Thereafter, they will attend full-time for one session per year and will be free to undertake full-time employment for the remainder of the year, approximately 35 weeks. The standard time for completion of the Sandwich Course is seven years. It is also possible for a student in the Sandwich Course to attend both sessions in a year and thus decrease the length of his course by one year. The implementation of the Sandwich Course is set out in the diagram entitled *Bachelor of Surveying — Sandwich Course* below.

Part 7 of the course, the first half of the fourth year, is taken up by 29.193 Professional Training. Students who are unable to obtain suitable employment are advised to contact the Professional Training Officer in the School, who will assist in seeking out employment.

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.

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Surveying — Full-time Course
Bachelor of Surveying
BSurv

Year 1
Session 1 **(Part 1)**

		Hours Per Week
1.971	Physics I	6
5.030	Engineering C*	5
10.001	Mathematics I	6
29.001	Surveying IA	5½
		22½

*Introduction to Systems and Computers Option.

Year 1
Session 2 **(Part 2)**

1.971	Physics I	6
5.010	Engineering A*	6
10.001	Mathematics I	6
29.002	Surveying IB	6½
29.191	Survey Camp†	—
		24½

*4.901 Materials Option.

†Students are required to attend a one week survey camp, which is equivalent to 40 class contact hours.

Year 2
Session 1 **(Part 3)**

		Hpw
10.022	Engineering Mathematics II	4
10.341	Statistics SU	1½
29.011	Surveying IIA	4½
29.151	Survey Computations I	6
1.962	Physics of Measurement	3
27.295	Physical Geography for Surveyors†	4
		23

†A one-day field tutorial is an essential part of this course.

Year 2
Session 2 **(Part 4)**

6.822	Electronics	3
8.711	Engineering for Surveyors	3
10.022	Engineering Mathematics II	4
10.341	Statistics SU	1½
29.012	Surveying IIB	4½
29.192	Survey Camp*	—
29.161	Hydrographic Surveying I	2
	or	
29.182	Cartography Elective	
	General Studies Elective	3
		21

*Students are required to attend a one-week survey camp, which is equivalent to 40 class contact hours.

Year 3
Session 1 **(Part 5)**

8.712	Engineering for Surveyors	3
29.311	Astronomy I	3
29.511	Photogrammetry I	6
29.621	Land Development I	4
29.631	Land Inventory I	2
36.411	Town Planning	2
	General Studies Elective	3
		23

Year 3
Session 2 **(Part 6)**

29.103	Surveying III	7
29.152	Survey Computations II	3
29.211	Geodesy I	6
29.622	Land Development II	3
29.641	Land Law and Tenure I	2
	General Studies Elective	3
		24

Year 4
Session 1 **(Part 7)**

29.193	Professional Training	5 months
29.194	Survey Camp*	2 weeks: Field
		2 weeks: Campus

*Students are required to attend a four-week survey camp, equivalent to 160 hours of class contact.

Year 4
Session 2 **(Part 8)**

		Hpw
8.713	Management for Surveyors	2
29.212	Geodesy II	3
29.312	Astronomy II	3
29.512	Photogrammetry II	3
	General Studies Advanced Elective	3
	Two Electives†	6
		20

†Electives chosen from:
29.162 Hydrographic Surveying II
29.183 Cartography Advanced Elective
29.213 Geodesy III
29.313 Astronomy III
29.513 Photogrammetry III
29.173 Project
29.623 Land Development III
29.632 Land Inventory II
29.642 Land Law and Tenure II

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Surveying — Sandwich Course
Bachelor of Surveying
BSurv

Students commencing the Sandwich Course in 1978 *either* attend full-time for one year in 1978 and switch to Part 3 of the sandwich course in 1979 *or* take part-time classes in 1978 and 1979 (part-time Stages 1 and 2) and switch to Part 3 of the sandwich course in 1980. See diagram below.

1. Full-time

See Year 1, full-time course.

2. Part-time

		Hours Per Week
Stage 1		
1.001	Physics I	6
10.001	Mathematics I	6
		12

Stage 2

		S1	S2
5.010	Engineering A*	6	0
5.030	Engineering C**	0	5
29.001	Surveying IA	5½	0
29.002	Surveying IB	0	6½
29.191	Survey Camp†	—	—
		11½	11½

*4.901 Materials Option.
**Introduction to Systems and Computers Option.
†Students are required to attend a one-week survey camp equivalent to 40 class contact hours.

3. Sandwich Course

Part 3

Offered in Session 1

		Hours Per Week
10.022	Engineering Mathematics II	4
10.342A	Statistics SU	1½
29.011	Surveying IIA	4½
29.151	Survey Computations I	6
1.962	Physics of Measurement	3
27.295	Physical Geography for Surveyors†	4
		23

†A one-day field tutorial is an essential part of this course.

Part 4

Offered in Session 1

6.822	Electronics	3
10.342B	Statistics SU	1½
8.711	Engineering for Surveyors	3
10.022	Engineering Mathematics II	4
29.012	Surveying IIB	4½
29.192	Survey Camp**	—
29.161 / 29.182	Hydrographic Surveying or Cartography Elective	2
	General Studies Elective	3
		21

**Students are required to attend a one-week survey camp, equivalent to 40 class contact hours during Session 2 along with the full-time students.

Part 5

Offered in Session 1

8.712	Engineering for Surveyors II	3
29.311	Astronomy I	3
29.511	Photogrammetry I	6
29.621	Land Development I	4
29.631	Land Inventory I	2
36.411	Town Planning	2
	General Studies Elective	3
		23

Part 6

Offered in Session 2

29.103	Surveying III	7
29.152	Survey Computations II	3
29.211	Geodesy I	6
29.622	Land Development II	3
29.641	Land Law and Tenure	2
	General Studies Elective	3
		24

Part 7

Offered in Session 1

29.193	Professional Training	
29.194	Survey Camp*	2 weeks: Field 2 weeks: Campus

*Students are required to attend a four-week survey camp, equivalent to 160 hours of class contact.

Part 8

Offered in Session 2

		Hpw
8.713	Management for Surveyors	2
29.212	Geodesy II	3
29.312	Astronomy II	3
29.512	Photogrammetry II	3
	General Studies Advanced Elective	3
	Two Electives†	6
		20

†Electives chosen from:
29.162 Hydrographic Surveying II
29.183 Cartography Advanced Elective
29.213 Geodesy III
29.313 Astronomy III
29.513 Photogrammetry III
29.173 Project
29.623 Land Development III
29.632 Land Inventory II
29.642 Land Law and Tenure II

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Surveying — Part-time Course
Bachelor of Surveying
BSurv

Stages 3, 4, 5 and 6

No longer offered.

Stage 7

		Hours Per Week
29.193	Professional Training	
29.212	Geodesy II	1½
29.312	Astronomy II	1½
29.512	Photogrammetry II	1½
8.713	Management for Surveyors	1
	Two Electives§	3
29.194	Survey Camp†	2 weeks: Field 2 weeks: Campus
		8½

§Electives chosen from
29.162 Hydrographic Surveying II
29.183 Cartography Advanced Elective
29.213 Geodesy III
29.313 Astronomy III
29.513 Photogrammetry III
29.623 Land Development III
29.632 Land Inventory II
29.642 Land Law and Tenure II
29.173 Project

†Students are required to attend a four-week survey camp, equivalent to 160 hours of class contact. Academic subjects are arranged so as not to clash with the camp.

Bachelor of Surveying

Sandwich Course

Year / Sandwich Course	1977		1978		1979		1980	
	S1	S2	S1	S2	S1	S2	S1	S2
Part 1	Students commencing the Sandwich Course *either* attend full-time for one year *or* take part-time classes for two years before switching to Part 3 of the Sandwich Course.							
Part 2								
Part 3	Part 3		Part 3		Part 3		Part 3	
Part 4	Part 4		Part 4		Part 4		Part 4	
Part 5	Part 5		Part 5		Part 5		Part 5	
Part 6		Part 6		Part 6		Part 6		Part 6
Part 7			Part 7		Part 7		Part 7	
Part 8				Part 8		Part 8		Part 8

Graduate School of Engineering

Graduate Study

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 please see the Graduate School of Engineering Handbook and the brochures prepared by the Schools.

The Faculty of Engineering provides facilities for well-qualified graduates to engage in advanced studies and research leading to the award of the degrees of Doctor of Philosophy, Master of Engineering or Master of Surveying in all six schools. In addition the degree of Master of Science is available through the Schools of Civil Engineering, Electrical Engineering, Mechanical and Industrial Engineering, and Transport and Highways.

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 together with the possibility of interdisciplinary studies. In 1976 a new set of faculty-wide regulations for graduate diplomas was introduced, which includes provision for interdisciplinary study in the new Graduate Diploma in Engineering Developments, as well as more flexibility in the Graduate Diplomas in Highway Engineering, Human Communication, Industrial Engineering and Transport.

Students are advised to consult the Graduate Handbook for further information.

The conditions for the award of the various higher degrees and graduate diplomas are published later in this Handbook.

The degrees of Master of Engineering Science and Master of Surveying Science may be gained by:

1. formal course work; or

2. a combination of formal course work and the completion of a report on a project or a research thesis; or

3. completion of a research thesis.

The number of credits for a project report shall be 9, and for a research thesis 18 or 36.

Candidates proceeding to the degree of Master of Engineering Science and Master of Surveying Science are encouraged to develop interdisciplinary attitudes and, with the approval of the Head 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 the approval of the Head of School, is able to select a program of studies best suited to his needs.

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

The subjects which may be available for candidates proceeding to the degree of Master of Engineering Science or Master of Surveying Science are listed below under the various Schools. Not all electives will necessarily be offered in any particular year.

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

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1978 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1978* 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.

School of Civil Engineering

		Credits
8.701G	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 1	3
8.749G	Pavement Materials 2	3
8.750G	Pavement Design and Evaluation 1	3
8.751G	Pavement Design and Evaluation 2	3
8.752G	Terrain Engineering	3
8.753G	Soil Mechanics I	3
8.754G	Soil Mechanics II	3
8.755G	Materials of Construction I	3
8.756G	Materials of Construction II	3
8.758G	Soil Mechanics III	3
8.759G	Rock Mechanics	6
8.760G	Materials Construction III	3
8.764G	Composites in Civil Engineering	3
8.766G	Welding in Structural Engineering	3
8.768G	Fracture Mechanics	3
8.771G	Foundation Engineering	6
8.802G	Elastic Stability I	3
8.803G	Elastic Stability II	3
8.804G	Vibrations of Structures I	3
8.805G	Vibrations 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 1 (Safe 1)	3
8.821G	Structural Analysis and Finite Elements 2 (Safe 2)	3
8.822G	Structural Analysis and Finite Elements 3 (Safe 3)	3
8.830G	Hydromechanics	3
8.831G	Closed Circuit 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	Hydrological Design	3
8.839G	Advanced Methods of Flood Estimation	3
8.840G	Hydrological Models and Data Synthesis	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
8.855G	Water and Wastewater Analysis and Quality Requirements	3
8.856G	Water Treatment	3
8.857G	Sewage Treatment and Disposal	3
8.858G	Water Quality Management	3
8.860G	Investigation of Groundwater Resources 1	3
8.861G	Investigation of Groundwater Resources 2	3
8.862G	Fluvial Hydraulics	3
8.863G	Estuarine Hydraulics	3
8.901G	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.

School of Electrical Engineering

Each subject (except 6.909G, 6.918G and 6.936G) counts as three 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 Radiators and Applications
6.166G Wave Propagation Theory
6.167G Microwave Transmission Theory
6.169G Microwave Circuits: Theory and Techniques
6.170G Microwave Electronics
6.171G Network Synthesis
6.172G Advanced Network Synthesis
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 Transmission
6.257G Electric Power Distribution Systems
6.341G Signal Analysis and Transmission Through Networks and Systems
6.342G Information and Communication Theory
6.343G Modulation Theory and Application to Systems
6.344G Optimal Design of Communication Systems
6.345G Active and Adaptive Circuits for Integrated Systems
6.346G Acoustics
6.347G Digital Communication Systems
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
6.381G Biology and Physiology for Engineers
6.382G Biomedical Engineering
6.452G Principles of Feedback Control
6.453G Optimization in Systems Engineering
6.455G System Identification and Modelling
6.456G General Concepts in Formal System Theories
6.457G Cybernetic Systems Theory
6.458G Pattern Recognition Systems
6.459G Control Computing
6.460G Real Time Computing
6.461G Large Scale Systems
6.464G Stochastic Processes in Automatic Control
6.466G Advanced Linear Control Theory
6.470G Advanced Topics in Control
6.650G Computer Science Elective
6.651G Digital Electronics
6.654G Switching Theory and 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.

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
5.101-2G	Optimization Methods for Mechanical Engineers I, II	2, 2
5.110G	Morphology of Design	4
*5.151-2G	Refrigeration and Air Conditioning Design I, II	3, 3
5.304-5G	Advanced Dynamics 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
5.401G	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

		Credits
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
5.725G	Statistical Thermodynamics	2
5.735G	Direct Energy Conversion	2
*5.751-2G	Refrigeration, 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.

Department of Industrial Engineering

		Credits
18.061G*	Industrial Experimentation I	3
18.062G*	Industrial Experimentation II	3
18.073G*	Ergonomics	2
18.171G*	Inspection and Quality Control	3
18.271G*	Theory of Machining and Forming Processes	3
18.272G*	Technology of Machining and Forming Processes	3
18.371G*	Factory Design and Layout	3
18.461G*	Design for Production	4
18.462G*	Industrial Design	2
18.463G*	Tool Design	4
18.471G*	Design Communication	2
18.472G*	Engineering Design Analysis	6
18.571G	Operations Research I	6
18.574G	Operations Research II	3
18.671G	Decision Theory	2
18.761G	Simulation in Operations Research	3
18.763G	Variational Methods in Operations Research	2
18.770G	Stochastic Control	2
18.772G	Information Processing Systems in Organisations	2
18.774G	Applied Stochastic Processes	2
18.775G	Networks and Graphs	2
18.776G	Production and Inventory Control	2
18.777G	Time Series and Forecasting	2
18.778G	Scheduling and Sequencing	2
18.779G	Game Theory	2
18.862G	Linear Programming	2
18.863G	Non-Linear Programming	2
18.871G	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 Optimisation	2
18.878G	Industrial Applications of Mathematical Programming	2
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

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

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
29.106G	Special Topic A	3
29.107G	Special Topic B	3
29.154G	Adjustment of Observations	6
29.163G	Mathematical Methods 1 Numerical Analysis	3
29.164G	Mathematical Methods 2 Statistics of Observations	3
29.165G	Mathematical Methods 3 Ellipsoidal Harmonics	3
29.215G	Geometrical Geodesy	3
29.216G	Geodetic Surveying	3
29.223G	Dynamic Geodesy	3
29.224G	Physical Geodesy	6
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
29.909G	Project	9
29.918G	Research Project	18
29.936G	Research Project	36

School of Transport and Highways

		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 1	3
24.011G	Highway Engineering Practice Part 2	3
24.012G	Economics for Transport Studies	3
24.013G	Transport Economics	3
24.014G	Transport Systems Part 1	3
24.015G	Transport Systems Part 2	3
24.016G	Traffic Engineering	6
24.017G	Transport and Traffic Flow Theory	6
24.018G	Statistics for Transport Studies Part 1	3
24.019G	Statistics for Transport Studies Part 2	3
24.020G	Mathematical Techniques for Transport Studies	3
24.021G	Law and Administration	3
24.022G	Pavement Materials 1	3
24.023G	Pavement Materials 2	3
24.024G	Pavement Design and Evaluation 1	3
24.025G	Pavement Design and Evaluation 2	3
24.026G	Bridges and Highway Structure Part 1	3
24.027G	Bridges and Highway Structure Part 2	3
24.028G	Transport and Highways Elective	3
24.909G	Project	9
24.918G	Research Project	18
24.936G	Research Project	36

Graduate Diplomas in Engineering

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, the number of credits for each subject being determined by Faculty on the recommendation of Heads of Schools; normally one credit is equal to attendance for one hour per week for one session. 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 in Engineering Developments is intended for those who wish to take a more general program in several areas of interest. The course 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.

Other subjects which may be available in the graduate diploma course are listed below under the various schools. Not all electives are necessarily offered in any particular year.

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	Introduction to Accounting A	3
14.002	Introduction to Accounting B	
14.042G	Industrial Law	2
14.062G	Accounting for Engineers	3

School of Transport and Highways

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 1	7
24.110G	Road Location and Design Part 2	7
24.111G	Road Construction	6
24.112G	Highway Materials	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.

97.001G	Linguistics and Written and Spoken Communication	2
97.002G	Basic Information Theory	6
97.004G	Psychology of Communication	3
97.005G	Audio and Video Equipment — Capabilities and Applications	4
97.012G	Project	5
97.007G	Audio Video Signals in Communication	3
97.008G*	Body in Communication	2
97.013G	Presentation of Information	3
97.010G	Basic Fortran	2

*Half-session only.

Subjects offered by Tape Correspondence

5.075G	Computational Methods in Mechanical Engineering, Part 1	2
5.076G	Computational Methods in Mechanical Engineering, Part 2	2
6.345G	Active and Adaptive Circuits for Integrated Systems	3
6.373G	Semiconductor Devices	3
6.376G	Reliability Engineering	3
6.377G	Integrated Circuit Design	3
6.378G	Solar Energy Conversion	3
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

*See the Calendar for further information on the Division of Postgraduate Extension Studies.

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 **Preparation and Submission of Project Reports and Theses for Higher Degrees** *and* **Policy with respect to the use of Higher Degree Theses** see the Calendar.

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 Building	MBuild	Architecture
Master of Business Administration	MBA	AGSM
Master of Chemistry by Formal Course Work	MChem	Sciences*
Master of Commerce (Honours)	MCom(Hons)	Commerce
Master of Commerce by Formal Course Work	MCom	Commerce
Master of Counselling (Education)	MCouns(Ed)	Professional Studies
Master of Education	MEd	Professional Studies
Master of Engineering Master of Engineering without Supervision	ME	Applied Science Engineering Military Studies
Master of Engineering Science	MEngSc	Engineering
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 by Formal Course Work Master of Librarianship by Research	MLib	Professional Studies
Master of Mathematics	MMath	Sciences*
Master of Optometry	MOptom	Sciences*
Master of Psychology	MPsychol	Sciences‡
Master of Public Administration	MPA	AGSM
Master of Science Master of Science without Supervision	MSc	Applied Science Engineering Medicine Military Studies Professional Studies Sciences*‡
Master of Science (Acoustics)	MSc(Acoustics)	Architecture
Master of Science and Society by Formal Course Work	MScSoc	Sciences*
Master of Science (Biotechnology)	MSc(Biotech)	Sciences‡
Master of Science (Building)	MSc(Building)	Architecture
Master of Science (Building Services)	MSc(Building Services)	Architecture**
Master of Social Work by Research Master of Social Work by Formal Course Work	MSW	Professional Studies

Title	Abbreviation	Calendar/Handbook	
Master of Statistics	MStats	Sciences*	
Master of Surgery	MS	Medicine	
Master of Surveying Master of Surveying without Supervision	MSurv	Engineering	
Master of Surveying Science	MSurvSc	Engineering	
Master of Town Planning	MTP	Architecture	
Graduate Diploma	GradDip	Applied Science Architecture Engineering Sciences*‡	**Graduate Diplomas**
Graduate Diploma in the Faculty of Professional Studies	DipArchivAdmin DipEd DipLib GradDip	Professional Studies	

**Not available to new students.
*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 he 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 appropriate Faculty or Board of Studies 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 Faculty or Board of Studies.

3. When the Faculty or Board of Studies is not satisfied with the qualifications submitted by a candidate, the Faculty or Board of Studies may require him, before he is permitted to register, to undergo such examination or carry out such work as the Faculty or Board of Studies may prescribe.

Registration

4. A candidate for registration for a course of study leading to the degree of Doctor of Philosophy shall:

(1) apply to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which he desires to register; and

(2) submit with his application a certificate from the head of the University school in which he proposes to study stating that the candidate is a fit person to undertake a course of study and research leading to the degree of Doctor of Philosophy and that the school is willing to undertake the responsibility of supervising the work of the candidate and of reporting to the Faculty or Board of Studies at the end of the course on the merits of the candidate's performance in the prescribed course.

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 his degree, who before registration was engaged upon research to the satisfaction of the Faculty or Board of Studies, may be exempted from not more than two academic sessions;

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

(3) in exceptional cases, the Professorial Board on the recommendation of the Faculty or Board of Studies 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 himself for examination not later than ten academic sessions from the date of his 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 Faculty or Board of Studies.

7. The candidate shall be required to devote his whole time to advanced study and research, save that:

(1) the Faculty or Board of Studies may permit a candidate on application to undertake a limited amount of University teaching or outside work which in its judgment 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 Faculty or Board of studies shall prescribe a minimum period for the duration of the program;

(3) in special circumstances, the Faculty or Board of Studies 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 his program in a school of the University. In such a case the Faculty or Board of Studies shall prescribe for the duration of his program a minimum period which, in its opinion, having regard to the proportion of his time which he 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 his program under the direction of a supervisor appointed by the Faculty or Board of Studies 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 Faculty or Board of Studies may permit candidates to conduct their 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 his research for approval by the Faculty or Board of Studies. After the topic has been approved it may not be changed except with the permission of the Faculty or Board of Studies.

10. A candidate may be required by the Faculty of Board of Studies to attend a formal course of study appropriate to his work.

Thesis

11. On completing his 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 his research. In special cases work done conjointly with other persons may be accepted, provided the Faculty or Board of Studies is satisfied on the candidate's part in the joint research.

13. Every candidate shall be required to submit with his 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 his thesis any work or material which he has previously submitted for a university degree or other similar award.

Entry for Examination

15. The candidate shall give in writing two months' notice of his intention to submit his thesis and such notice shall be accompanied by the appropriate fee.

16. Four copies of the thesis shall be submitted together with a certificate from the supervisor that the candidate has completed the course of study prescribed in his case. The 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 he has 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 Faculty or Board of Studies, at least one of whom shall be an external examiner.

19. After examining the thesis the examiners may:

(1) decide that the thesis reaches a satisfactory standard; or

(2) recommend that the candidate be required to re-submit his thesis in revised form after a further period of study and/or research; or

(3) recommend without further test that the candidate be not awarded the degree of Doctor of Philosophy.

*See Conditions for the Award of Degrees in the Calendar.

20. If the thesis reaches the required standard, the examiners shall arrange for the candidate to be examined orally, and, at their discretion, by written papers and/or practical examinations on the subject of the thesis and/or subjects relevant thereto, save that on the recommendation of the examiners the Faculty or Board of Studies may dispense with the oral examination.

21. If the thesis is of satisfactory standard but the candidate fails to satisfy the examiners at the oral or other examinations, the examiners may recommend the University to permit the candidate to represent the same thesis and submit to a further oral, practical or written examination within a period specified by them but not exceeding eighteen months.

22. At the conclusion of the examination, the examiners will submit to the Faculty or Board of Studies a concise report on the merits of the thesis and on the examination results, and the Faculty or Board of Studies shall recommend whether or not the candidate may be admitted to the degree.

23. A candidate shall be required to 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 granted by the Council on the recommendation of the Professorial Board to a candidate who has demonstrated ability to carry out research by the submission of a thesis embodying the results of an original investigation.

2. An application to register as a candidate for the degree of Master of Engineering 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.

3. (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 Faculty (hereinafter referred to as 'the Faculty').

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

5. In every case, before permitting an applicant to register as a candidate, the Faculty shall be satisfied that adequate supervision and facilities are available.

6. An approved applicant shall register in one of the following categories:

(1) student in full-time attendance at the University;

(2) student in part-time attendance at the University;

(3) student working externally to the University;

and shall pay such fees as may be determined from time to time by the Council.

7. Every candidate for the degree shall be required to carry out a program of advanced study to take such examinatons and perform such other work as may be prescribed by the Faculty. The program shall include the preparation and submission of a thesis embodying the results of an original investigation, three copies of 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.

8. 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.

9. The investigation and other work as provided in paragraph **7.** shall be carried out under the direction of a supervisor appointed by the Faculty or under such conditions as the Faculty may determine.

10. 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 Faculty, be reduced by up to two sessions.

11. For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Faculty, one of whom shall, if possible, be an external examiner.

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 Professorial Board to a candidate who has:

(1) completed 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

(2) demonstrated ability to carry out research by the submission of a thesis embodying the results of an original investigation; or

(3) completed an approved combination of the above.

2. (1) An application to register 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 course.

(2) 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.

3. (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.

*See Conditions for the Award of Degrees in the Calendar.

(2) A graduate with a pass degree of good standing from an appropriate degree course with academic standards equivalent to the Bachelor course 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 Faculty.

(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 Faculty on the recommendation of its Higher Degree Committee.

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

5. 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 Faculty 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.

6. 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.

7. An approved candidate shall register in one of the following categories:

(1) student in full-time attendance at the University,

(2) student in part-time attendance at the University,
and shall pay such fees as may be determined from time to time by Council.

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.

9. (1) The project forming the basis for the thesis shall be conducted under a supervisor appointed by the Faculty or under such conditions as Faculty may determine, to the satisfaction of the Head of School.

(2) For each candidate who submits a thesis as provided in paragraph **1.** (2) there shall be at least two examiners appointed by the Professorial Board on the recommendation of Faculty, one of whom shall, if possible, be an external examiner.

(3) The report on the project (9 credits) provided in paragraph **1.** (1) 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.

10. Every candidate who submits a thesis (18 or more credits) as provided in paragraph **1.** (2) 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 **1.** (1) shall comply with the requirements of the Faculty for the preparation and submission of project reports.*

11. The examiners referred to in paragraph **9.** (2) shall submit to the Faculty a report on the merits of the thesis, and the Faculty shall recommend whether or not the candidate be admitted to the degree.

Master of Science (MSc)

1. The degree of Master of Science may be granted by the Council on the recommendation of the Professorial Board to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

2. 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.

3. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor of Science 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 Faculty or Board of Studies.

4. Notwithstanding any other provisions of these conditions the Faculty or Board of Studies may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Faculty or Board of Studies may determine.

5. In every case before permitting an applicant to register as a candidate the Faculty or Board of Studies shall be satisfied that adequate supervision and facilities are available.

6. An approved applicant shall register in one of the following categories:

(1) student in full-time attendance at the University;

(2) student in part-time attendance at the University;

(3) student working externally to the University;
and shall pay such fees as may be determined from time to time by the Council.

*See Conditions for the Award of Degrees in the Calendar.

7. 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 Faculty or Board of Studies. 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 submit also for examination any work he has published whether or not such work is related to the thesis.

8. 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.

9. The investigation, design and other work as provided in paragraph **7.** shall be carried out under the direction of a supervisor appointed by the Faculty or Board of Studies or under such conditions as the Faculty or Board of Studies may determine.

At least once a year and at any other time that the Higher Degree 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.

10. 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 in 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.

11. (1) A candidate shall give in writing to the Registrar two months' notice of his intention to submit his 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) After examining the thesis an examiner may:

(a) recommend that the candidate be awarded the degree without further examination

or

(b) recommend that the candidate be awarded the degree subject to minor corrections as listed being made to the satisfaction of the Head of School

or

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

or

(d) recommend that the candidate be not awarded the degree and be not permitted to resubmit his thesis.

(4) In considering a recommendation made in terms of clause (c) of sub-condition (3) of this condition the Committee may specify the period within which the thesis is to be resubmitted.

(5) Having considered the examiners' reports the Committee shall recommend to the Professorial Board whether or not the candidate should be admitted to the degree.

*See Conditions for the Award of Degrees in the Calendar.

Master of Science Master of Engineering or Master of Surveying without Supervision

Where it is not possible for candidates to register under the existing 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:

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 Faculty, not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his own interest at an early stage, seek the advice of the appropriate School with regard to the adequacy of the subject matter for the degree. A synopsis of the work should be enclosed.

2. An applicant for registration shall have been admitted to a degree of Bachelor in the University of New South Wales.

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

4. (1) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an original investigation or design. The thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.* A candidate may submit also for examination any work he has published, whether or not such work is related to the thesis.

(2) 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.

5. 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.

6. 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.

7. For each candidate there shall be at least two examiners appointed by the Professorial Board on the recommendation of the appropriate Faculty, one of whom shall be an internal examiner.

8. 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 University. 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.

*See Conditions for the Award of Degrees in the Calendar.

Master of Surveying (MSurv)

1. The degree of Master of Surveying may be granted by the Council on the recommendation of the Professorial Board to a candidate who has demonstrated ability to carry out research by the submission of a thesis embodying the results of an original investigation.

2. An application to register as a candidate for the degree of Master of Surveying 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.

3. (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 Bachelors 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 Faculty.

(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 Faculty on the recommendation of its Higher Degree Committee.

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

5. In every case before permitting an applicant to register as a candidate the Faculty shall be satisfied that adequate supervision and facilities are available.

6. An approved applicant shall register in one of the following categories:

(1) student in full-time attendance at the University;

(2) student in part-time attendance at the University;

(3) student working externally to the University;

and shall pay such fees as may be determined from time to time by the Council.

7. 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 Faculty. The program shall include the preparation and submission of a thesis embodying the results of an original investigation, three copies of 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.

8. 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.

*See Conditions for the Award of Degrees in the Calendar.

9. The investigation and other work as provided in paragraph **7.** shall be carried out under the direction of a supervisor appointed by the Faculty or under such conditions as the Faculty may determine.

10. 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 Faculty, be reduced by up to two sessions.

11. For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Faculty, one of whom shall, if possible, be an external examiner.

Graduate Diploma

Graduate Diploma (GradDip)

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

2. An applicant for admission to a graduate diploma course shall be:
(1) a graduate of the University of New South Wales or other approved university.
(2) a person with other qualifications as may be approved by Faculty.

3. Notwithstanding clause **2.** above, Faculty may require an applicant to take such other prerequisite or concurrent studies and/or examinations as it may prescribe.

4. Every candidate for a graduate diploma shall be required to undertake the appropriate course of study, to pass any prescribed examinations, and if so laid down in the course, to complete a project or assignment specified by the Head of the School. The format of the report on such project or assignment shall accord with the instructions laid down by the Head of the School.

5. An approved applicant shall be required to pay the fee for the course in which 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 description, in the section entitled **Subject Descriptions.**

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.

The identifying numbers for each School are set out below.

Reference book lists are not published here, but are available from the various Schools.

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* Session 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).

	School, Department etc *Subjects also offered for courses in this handbook.	Faculty	Page
1	School of Physics*	Science	129
2	School of Chemistry*	Science	130
3	School of Chemical Engineering*	Applied Science	131
4	School of Metallurgy*	Applied Science	131
5	**School of Mechanical and Industrial Engineering**	**Engineering**	**88**
6	**School of Electrical Engineering**	**Engineering**	**95**
7	School of Mining Engineering	Applied Science	
8	**School of Civil Engineering**	**Engineering**	**105**
9	School of Wool and Pastoral Sciences	Applied Science	
10	School of Mathematics*	Science	131
11	School of Architecture	Architecture	
12	School of Psychology	Biological Sciences	
13	School of Textile Technology	Applied Science	
14	School of Accountancy*	Commerce	131
15	School of Economics*	Commerce	133
16	School of Health Administration	Professional Studies	
17	Biological Sciences	Biological Sciences	
18	**Department of Industrial Engineering**	**Engineering**	**115**
21	Department of Industrial Arts	Professional Studies	
22	School of Chemical Technology	Applied Science	
23	**School of Nuclear Engineering**	**Engineering**	**119**
24	**School of Transport and Highways**	**Engineering**	
25	School of Applied Geology	Applied Science	
26	Department of General Studies	Board of Studies in General Education	
27	School of Geography*	Applied Science	133
28	School of Marketing	Commerce	
29	**School of Surveying**	**Engineering**	**129**
30	Department of Behavioural Science	Commerce	
31	School of Optometry*	Science	133
33	Graduate School of Business	Commerce	
35	School of Building	Architecture	
36	School of Town Planning*	Architecture	133
38	School of Food Technology	Applied Science	
40	Professorial Board		
41	School of Biochemistry	Biological Sciences	
42	School of Biological Technology	Biological Sciences	
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	
65	School of Spanish and Latin American Studies	Arts	
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	
71	School of Medicine	Medicine	
72	School of Pathology	Medicine	
73	School of Physiology and Pharmacology	Medicine	
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
77	School of Psychiatry	Medicine	
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**		128

School of Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A SS L4T2

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.

5.0102 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 or co-requisite: 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 L4T2

Engineering Drawing: Fundamental concepts of descriptive geometry, including reference systems, representation of point, line and plane; fundamental problems of position and measurement. Application of descriptive geometry to certain problems arising in engineering practice. Special emphasis on ability to visualize problems and processes involved in their solution. Instruction in the correct use of drawing instruments and the application of drawing standards. Measurements and dimensioning. Orthographic and isometric projections.

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

1. (Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option) *Design for Manufacture I:* Approximately 30 hours of workshop training, including casting, fitting, machining, welding.

Principles of design for manufacture.

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 Systems and Computers:* Introduction to computers to follow the computer work in Mathematics I. To develop: (1) familiarity with algorithms; (2) the use of procedure-oriented languages; and (3) an introduction to computing equipment.

Systems. To give students an appreciation of some of the concepts used in engineering, to relate the concepts to phenomena within their experience, and to illustrate them by case histories and engineering examples. Quantities. Concepts. Components. Systems.

4. (Chemical Engineering students must take this option) *Introduction to Chemical Engineering:* 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.

5. (Metallurgy students must take this option) *Introduction to Metallurgical Engineering:* 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.

6. (Mining Engineering students must take this option) *Introduction to Mining Engineering:* Mineral deposits; metallic, nonmetallic 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.

7. (Electrical Engineering students must take this option) *Introduction to Computing:* 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.

8. (Industrial Chemistry students take this option) *Introduction to Chemical Technology:* Introduction to computation in

chemical technology: process flow diagrams, information 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.

9. (Ceramic Engineering students take this option) *Introduction to Ceramic Engineering:* 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 L1T2

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: 1.951, 5.040, 10.001. Co- or prerequisites: 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.

5.040 Engineering D — SS L3T5

Co- or prerequisites: 5.010, 5.030.

Mechanics of Solids M: 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: A further 30 hours of workshop training. Design for manufacture.

5.042 Industrial Experience — L0T0

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 — L0T0

An industrial training report must be submitted to the School for assessment after completion of the period of training and must meet School requirements.

For details contact Mr G. Crawford, Industrial Training Officer.

5.044 Industrial Training II — L0T0

An industrial training report must be submitted to the School for assessment after completion of the period of training and must meet School requirements.

For details contact Mr G. Crawford, Industrial Training Officer.

5.051 Thesis — F L0T6

Prerequisite: All subjects in Years 1, 2 and 3.

For students in the full-time courses in the School of Mechanical and Industrial Engineering.

5.061 Technical Orientation — S1 L2T0

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 χ_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.

5.111 Mechanical Engineering Design I — F L1T2

Prerequisites: 5.010, 5.030, 5.040. Co- or prerequisites: 5.311 or 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 prerequisites: 5.071, 5.331, 5.412, 5.612.

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

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.

5.301 Engineering Mechanics SS L1T1

Prerequisites: 1.951, 5.010. Co- or prerequisite: 10.001.

Kinematics and kinetics of the plane motion of particles. Rectilinear, curvilinear and relative translational motion; work and energy; impulse and momentum.

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.

5.311 Engineering Mechanics SS L1½T1

Prerequisites: 1.951, 5.010, 5.020 & 10.001 or 10.011.

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

5.324 Automatic Control Engineering F L2T1

Prerequisite: 10.022.

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 SS L2½T1½

Prerequisites: 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; dynamic equilibrium, differential equations of motion; work and energy, variational principles; impulse and momentum, impact.

5.331 Dynamics of Machines I F L1½T½

Prerequisites: 5.311 or 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 vibrations, 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.

5.411 Mechanics of Solids II SS L2T2

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, combined stresses, non-zero mean stress. Virtual work-unit load method of analysis of beams, frames and rings; deflections and redundants; three-moment equation. Torsion of prisms and thin-walled members; membrane analogy. Thick-walled cylinders; compound cylinders. Thick curved beams. Rotating discs. Inelastic behaviour of bars (tension), beams (bending), round shafts (torsion), columns (tangent modulus theory); autofrettage; residual stresses. Bending of plates.

5.413 Mechanics of Solids IV F L2T1

Prerequisite: 5.412.

Elasticity: Continuum Mechanics: Equilibrium and compatibility. Plates and shells, rotating discs. Contact stresses. Thermal stresses.

Stress Analysis: Experimental stress analysis. Numerical stress analysis. Use of computer packages.

Plasticity: Elastic and plastic creep. Residual stress. Limit theorems.

5.611 Fluid Mechanics/Thermodynamics I F L2T2

Prerequisites: 1.951, 5.010, 5.020, 10.001. Co- or prerequisites: 5.311, 10.022.

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. Turbomachines. 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 real cycles.

5.612 Fluid Mechanics/Thermodynamics II F L2½T1

Prerequisites: 5.311, 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 turbomachinery. Design considerations. Cavitation. Matching of component characteristics.

5.661 Mechanical Engineering III F L2T1

Prerequisites: 1.961 or equivalent, 10.211A.

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.

5.800 Aircraft Design SS L1½T1

Prerequisites: 5.111, 5.311 or 5.330, 5.411, 8.259. Co- or prerequisite: 5.412.

Aircraft types and development, overall design process, inertia forces, load factors, wing load, shear force, bending moment and torque distributions. Detailed stressing of lugs, sockets, pins, bearings, fittings, hinges, gears, riveted, welded and bonded joints. Design and drawing of small fittings such as hinge assembly, spar for tailplane, control stick or landing gear component.

5.801 Aircraft Design F L2T2

Prerequisites: 5.303, 5.412, 5.800 (full-time only), 5.811, 5.822. Co- or prerequisite: 5.823.

1. *Aerodynamic Design:* Design authorities, criteria, flight envelope, design cases. Airloads. Weight and Balance. Performance and stability estimation. Aerodynamic design of an aircraft.

2. *Design of Aircraft Structures:* Significance of design requirements: proof and ultimate load, load and safety factors, interpretation of V-g diagram. Stressing cases. Detailed structural and mechanical design of airframe, controls, joints; choice of materials; use of structures data sheets. Practical design of a simple aircraft structural component. Fatigue. Aeroelasticity.

5.811 Aerodynamics I F L2T1

Prerequisites: 5.311 or 5.330, 5.611, 10.022.

Elementary boundary layer theory; turbulence, convection, friction and form drag; bluff bodies, industrial aerodynamics, wind tunnels; test facilities. Airfoil families and characteristics. Vorticity and circulation; Prandtl wing theory, induced drag, spanwise lift distribution, wing characteristics. Static longitudinal stability and control. Manoeuvrability. Standard atmosphere, performance calculations. One-dimensional gas dynamics, isentropic, adiabatic and nozzle flow; rocket equation. Normal shock waves.

5.812 Aerodynamics II F L2T1

Prerequisites: 5.612 or 5.811; 5.303 or 5.331.

Compressible flow and high speed aerodynamics. Hypersonic and high enthalpy flow. Dynamic stability and control.

5.822 Analysis of Aerospace Structures I F L1½T½

Prerequisites: 5.311 or 5.330, 5.411, 8.259, 10.022. Co- or prerequisite: 5.412.

Equilibrium of forces, plane frames, space frames; beams; two-moment equation, shear and bending-stress distribution in various thin-webbed beams, tapered beams, beams with variable flange areas. Semimonocoque structures. Deflection of structures: Maxwell's and Castigliano's theorems, virtual work method. Statically indeterminate structures; beams, trusses, stiff-jointed frames; methods of superposition, energy, moment distribution, elastic centre; shear distribution in two-cell beam. Aircraft materials, physical properties and their measurement. Dimensionless stress-strain data.

5.823 Analysis of Aerospace Structure II F L1½T½

Prerequisites: 5.412, 5.822.

Stress functions. Shear lag. Strain gauge rosettes and structural testing. Sandwich construction and analysis. Buckling of columns; elastic, perfect, imperfect and inelastic columns; empirical equations. Buckling of plates with various loadings and edge conditions. Thin walled columns, local buckling, cuppling. Stiffened panels. Tension field beams, monocoque cylinders. Warping of open and closed sections. Torsional instability. Introduction to matrix methods of structural analysis.

5.831 Aircraft Propulsion F L1½T½

Prerequisites: 5.611, 5.811.

Propulsion systems. Thrust equations; propulsive efficiency. Propeller theory, characteristics and performance. Power plant thermodynamics. Fuels and combustion. Internal aerodynamics. Compressors and turbines, subsonic and supersonic intake diffusers, nozzles. Design and performance of aircraft reciprocating internal combustion engine and gas turbine systems. Ramjets, rockets.

5.911 Naval Architecture F L3T1

Prerequisite: 5.311 or 5.330. Co- or prerequisite: 5.951 (full-time only).

Hydrostatic calculations. Stability at small angles. Free-surface effects. Inclining experiment. Trim due to weights and flooding. Grounding. Effects of permeability. Stability at large angles. Stability after flooding. Dynamic stability. Floodable length. Requirements of damaged-stability. Wave theory. Wave patterns. Rolling, heaving and pitching. Launching.

5.921 Ship Structures I S2 L3T1

Prerequisites: 5.411, 8.259, 10.022. Co- or prerequisite: 5.412.

Longitudinal strength of ship structures: load types and load prediction; section modulus, shear lag, torsion, superstructure, discontinuities. Transverse strength; frame and finite element analysis. Limit analysis of beams. Brackets and connections. Combined axial and lateral loads. Laterally loaded plates, grillages and stiffened panels.

5.922 Ship Structures II S1 L3T1

Prerequisites: 5.071, 5.412, 5.921.

Buckling of plates and stiffened panels; combined loads; limit analysis. Structural details. Fatigue and brittle fracture. Design for production. Finite element method. Rational design synthesis: reliability, optimization, computer-aided structural design.

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 IB 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 II 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, free-board, tonnage, floodable length (if applicable), power requirements, propeller design, investigation of vibration, rudder design and final general arrangement.

5.941 Ship Propulsion and Systems F L2½T1½

Prerequisites: 5.071, 5.951 (full-time only).

Hydrodynamics. Model testing. Determination of resistance and power requirements of hull form from statistical data. Optimum form characteristics. Propulsion systems. Propeller theory and design. Trials and analysis of data. Steering. Ship vibrations. Prime movers and auxiliaries. Ship systems: ventilation, air-conditioning, refrigeration, pumping, flooding and draining.

5.951 Hydrodynamics SS L1T½

Prerequisites: 5.311 or 5.330, 5.611, 10.022. Co- or prerequisite: 5.071.

Kinematics of fluids, stream functions, velocity potentials, added mass, representation of bodies by source singularities, vorticity. Descriptive treatment of the effects of viscosity in typical situations, such as boundary layers and separation.

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.

5.037G 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.

5.101G Optimization Methods for Mechanical Engineers I C2

Mathematical theories of optimization. Calculus of variation.

5.102G Optimization Methods for Mechnical Engineers II C2

Application of theory with special reference to design of mechanical elements and systems.

5.110G Morphology of Design C4

Design strategy illustrated by a major engineering design. Problem recognition; economic analysis; decision making; model formulation and optimization. Design analysis, communication and implementation of solution.

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.

5.321G 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 systems. Describing functions and limit cycle amplitude and frequency determination. Studies of systems in which the following non-linearities dominate the behaviour: backlash, coulomb friction, dead-space, hysteresis and saturation. Analog simulation 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 equations 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.

5.401G 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 Anaylsis 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**

5.492G Biomechanics II **C2**

Mechanical approach to physiological problems: Mechanical properties of body components. Dynamic modelling of human body. Analysis of injury-producing situations. Design of biomechanical equipment: Human capabilities. Special constraints. Materials for internal use.

5.615G Reciprocationg 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.

5.725G 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; design of thermodynamic generator, thermoelectric cooler, magneto-thermoelectricity; radioisotope, solar powered generators; semiconductors, 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 Cryogenics I C2

5.752G Refrigeration, Air Conditioning and Cryogenics II C2

Thermodynamic principles, diagrams; properties of real fluids, refrigerants. Thermodynamics of change of phase; liquids and dilute solutions; mixtures of liquids; steady flow processes with binary mixtures; rectification of a binary mixture; absorption refrigeration; resorption refrigeration. The vapour compression cycle; multi-pressure systems; analysis of compressor performance; condensers, evaporators and expansion devices; properties of the ideal refrigerant; reversed cycles; analysis and performance characteristics of the complete cycle. Air-cycle, steam-jet refrigeration; application to air conditioning design; cooling towers, mixtures of gases and vapours; psychrometry, evaporative cooling of air; dehumidification of air. Thermoelectric cooling; Seebeck, Jouleau, conduction, Peltier, Thomson effects; thermodynamic analysis; thermoelectric materials. Production of low temperatures; liquefaction and rectification of gases; magnetic cooling; application to research.

5.758G Refrigeration and Air Conditioning Applications C4

Industrial, commercial and domestic application of refrigeration and air conditioning. The science and technology of foods. Building design and construction. Engineering acoustics. Refrigeration technology. Law in relation to engineering. Ergonomics and biomechanics.

5.909G Research Project C9

5.912G Naval Hydrodynamics I C2

5.913G Naval Hydrodynamics II C2

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

School of 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 Basic Circuit Theory S1 or S2 L2T2

Prerequisites: 1.961 or equivalent, 6.010, 10.001.

Lumped modelling concepts used in circuit theory and their relationship to observed physical properties and behaviour. Linear circuit elements. Kirchhoffs 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.

An introductory 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 **SS L2T2**

Prerequisites: 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: 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.

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 Systems and Feedback **S1 or S2 L2T2**

Prerequisite: 6.021A. Co-requisite: 10.111A, 10.1113, 10.1114.

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, transfer functions, responses, poles, zeros, stability, frequency response.

Analysis and design of feedback systems including block diagrams, feedback, stability criteria, sensitivity, root locus.

6.0312 Utilization of Electric Energy **S1 L2T2**

Co-requisite: 6.0311, 6.021B.

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 Electronic Circuits I **S1 L2T2**

Prerequisites 6.021A, 6.021C. Co-requisite: 6.0311.

Active devices and how they may be interconnected with other circuit elements to achieve some desired result. Includes basic transistor theory and properties, simple amplifier configurations and applications of negative feedback.

6.0314 Signal Processing **S2 L2T2**

Prerequisite: 6.0311.

Analysis of periodic and transient signals. Fourier methods. Transmission of signals through linear systems (continuous and discrete). Coupled circuits, two-port networks, filters. Transmission lines.

6.0315 Electrical Energy **S2 L2T2**

Prerequisite: 6.0312.

Features of the electrical supply system relevant to a user of electricity.

6.0316 Electronic Circuits II **S2 L2T2**

Prerequisite: 6.0313.

Extension of 6.0313 to include tuned and difference amplifiers, operational amplifiers, power amplifiers, oscillators, Schmitts; comparators and multivibrators with increasing emphasis on the integrated circuit embodiment of these.

6.0317 Communication Systems **S2 L2T2**

Prerequisite: 6.0313. Co-requisites: 6.0316, 6.0314.

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: 6.0313.

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 Circuits, Signals and Information Theory — SS L2T3

Prerequisites: 6.0314, 10.033, 10.361.

Circuit Theory and network synthesis. *Signal Analysis* and transmission through networks, including theory of noise and stochastic signals. Includes time frequency and mixed domain presentation; transients and other signals; correlation, convolution, etc.; statistical properties of signals; applications. *Information Theory* of discrete systems including coding and encoding of patterns. Information theory of continuous systems. Mathematical theory of signal detection, including an introduction to decision theory. Signal and system analysis in the light of information theory.

6.044 Electrical Product Design and Reliability — SS L2T3

The design and development of reliable, high-quality hardware, from components to systems: product and procurement specifications; factors in choice of system configuration, materials, components, processes, prediction of reliability, availability, system effectiveness; cost-of-ownership optimization; maintainability; thermal design; mechanical design; redundancy; design reviews; fault-free analysis; failure mechanisms; failure mode analysis; Monte Carlo simulation; worst case and statistical design; sensitivity analysis and marginal testing; component screening; product development; life testing, environmental testing, non-destructive testing; quality control, attribute sampling.

6.202 Power Engineering—Systems I — SS L2T3

Prerequisite: 6.0315.

An elective emphasizing parameters and performance of power system components: transmission lines, power system overvoltages, transformers, fault calculation, 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; power systems in society; distribution systems.

6.212 Power Engineering—Utilization — SS L2T3

Prerequisite: 6.0315. Co-requisite: 6.322.

Topics include: Machines and electrical drives, applications and control, in particular using power rectifiers 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

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 Communication Electronics — SS L2T3

Prerequisites: 6.0314, 6.0316, 6.0317. Desirable co-requisite: 6.313.

High frequency and noise performance of active and passive devices and circuits. Includes the following topics: high frequency transistor characterization; transistor noise properties; parametric amplifiers; Gunn and IMPATT diodes; quantum electronics; microwave valves; klystrons, travelling wave tubes, magnetrons.

6.313 Wave Radiation and Guidance — SS L2T3

Prerequisite: 6.0314.

A selection from the following topics:
Maxwell's equations. Poynting's theorem. Plane waves and spherical waves. Conductors and dielectrics. Propagation in free space. Reflection and refraction at the interface of two media. Propagation in anisotropic media. Ionospheric and tropospheric propagation. Guided waves. Types of transmission lines including coaxial and strip lines, surface-wave lines. Waveguides and cavities. Microwave components and signal sources.

Radiator characteristics and concept of spatial filters. Waveforms and spectra versus aperture distribution and radiation pattern. Noise characteristics in the microwave spectrum. Gain, efficiency and signal-to-noise ratio. Elementary radiators first-principle approach. Phased arrays. Travelling wave and frequency independent radiators. Illustration of applications of antenna theory including radio interferometers, large radio telescopes and satellite communication.

6.322 Electronics — SS L2T3

Prerequisites: 6.0314, 6.0316.

Topics include: *Amplifiers:* wide band, compensation, direct coupled, operational amplifiers. *Integrated Circuits:* non-linear and linear use in systems. *Pulse Circuits:* semiconductor switches; emitter coupled multivibrators; blocking oscillators. *Phase-lock Loops. Power Converters:* polyphase rectifiers, controlled rectifiers, inverters, firing circuits.

6.323 Signals in Communication Systems — S1 L2T3

Prerequisite: 6.0317. Co-requisite: A working knowledge of elementary Fourier transforms and of elementary probability is assumed (eg as included in 6.042).

Digital Transmission Systems: Pulse shaping, digital modulation, line coding; detection theory, regenerative repeaters; pulse distortion, intersymbol interference, adaptive equalization; coding for error control; ARQ and forward error correction systems; channel capacity; optimum receivers; synchronization; data transmission and data modems; PCM, error noise, quantizing, companding. *Analog Transmission Systems:* Linear and non-linear distortion, signal-to-distortion ratio; multipliers and modulators; linear and non-linear modulation (envelope modulation, SSB, angle modulation), signal-to-noise ratio, bandwidth-SNR exchange; noise factor; multiplexing techniques, loading criteria in FDM; relay systems, optimum spacing between repeaters; equalization, optimum terminal filters.

6.333 Communication Systems — SS L2T3

Prerequisites: 6.0314, 6.0316.

Sound Systems: Psychoacoustics, loudness, pitch, masking, binaural effects, characteristics of speech, bandwidth and intelligibility. Sound sources, piston radiator, exponential horn. Acoustic and mechanical equivalent circuits, transducers. Introduction to room acoustics. General communications: some extensions of subjects from 6.0317. *Television Systems:* Physiological aspects of television, television standards, colour systems, transmitters, receivers. *Radar:* Principles of pulse and CW radar, distance and direction-measuring equipment for navigation and surveying.

6.383 Biomedical Engineering — SS L2T3

Prerequisites: 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.

6.412 Automatic Control — S1 L2T3

Prerequisite: 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 nonlinearities present in the system and the synthesis of nonlinearities into the system to improve dynamic performance.

6.413 Modern Systems Engineering — S2 L2T3

Prerequisite: 6.412.

The understanding and use of methods to analyse and design control systems for complex dynamic plants. Applications from many fields, including power systems, communication systems, nuclear and steam generating plant, biological systems; extensive use of modelling, simulation and control design programs developed for the Cyber and Varian Computer systems.

6.432 Computer Control and Instrumentation — SS L2T3

Prerequisites: 6.0311, 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.

6.512 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

Prerequisite: 6.0316.

Development of theory of transistor operation including high injection level effects and three dimensional geometry effects. Kinetics of epigrowth, diffusion and oxide growth as far as these are required to permit the student to specify process cycles. Design of transistor in terms of desired diffusion profiles, oxide growth thicknesses, and the specification of process cycles. Extension of the above to passive components as used in integrated circuits. Design aspects of integrated circuits, covering aspects peculiar to integrated circuits such as distributed parameters, parasitic couplings, correlated component tolerances and variations, special DC biasing methods.

6.601A Introduction to Computer Science — S1 L3T2 or F L1½T1

Prerequisite: 10.001.

Introduction to programming, algorithm and data structure design programming in a high level algorithmic language which provides simple, high level program-control and data-structuring facilities. Introduction to data structures. Program verification. Introduction to computer organization; simple machine architecture, logical design; data storage devices; simple operating system concepts.

6.601B Assembler Programming and Non-Numeric Processing — S2 L3T2 or F L1½T1

Prerequisite: 10.001. Co-requisite: 6.601A.

Computer structure, machine language, instruction execution, addressing techniques and digital representation of data. Symbolic coding. Manipulation of strings, lists and other data structures.

6.600 Introduction to Computers — S2 L3T2

Exclusions: 6.620, 6.601A.

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).

6.620 Introduction to Computing Science **S1 L3T2**

Prerequisites: 10.001. Exclusions: 6.600, 6.601A, 6.6021D.

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 dynamic data structures. Introduction to computer organization: simple machine architecture. Introduction to operating systems and computing machinery.

6.631 Digital Logic and Systems **S2 L3T2**

Prerequisites: 6.620 or 6.600 (C). Exclusions: 6.602A, 6.021E, 6.031D.

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 sequential circuits, digital systems and PDP11 assembler programming.

6.641 Programming I **S2 L3T2**

Prerequisites: 6.620 or 6.600 (C).

Recursive programming: a direct development from 6.620; back-tracking algorithms; lists, queues, stacks; tree structures and their manipulation. Key transformations (hashing). Files: sequential access, random access; file updating and sorting. Data base concepts: file design; backup; recovery; Indexing. String manipulation: use of SNOBOL 4 for the expression of pattern-matching and associative algorithms.

6.602A Computer Systems I **S1 L2T3**

Prerequisite: 6.601B.

Switching algebra, simplification of switching functions, synchronous sequential networks, digital systems. Number systems, codes, computer arithmetic. Memory techniques and organization, microprogramming. Integrated circuits, device characteristics.

6.602B Computer Systems II **S2 L3T2**

Prerequisite: 6.601B.

Operating systems via an intensive case study of a particular system. Includes system initialization memory management, process management, handling of interrupts, basic input/output and file systems.

6.602C Computer Applications **S1 L3T2**

Prerequisite: 6.601A.

A selection of topics from: Computer simulation. Modelling of discrete event systems, with applications to queueing; Pseudo random number generation and testing; simulation languages, especially SIMULA. Optimization techniques: 'hill climbing', critical path method, dynamic programming, linear programming. The simplex and revised simplex methods. Job shop scheduling. Data processing, file and data management systems; use of COBOL; searching and sorting of files. Information retrieval: search on secondary keys, inverted files. Artificial intelligence. Social consequences of computer technology.

6.602D Programming Languages and Compiling Techniques **S2 L3T2**

Prerequisite: 6.601A.

Compiling Techniques: data structures; table look-up; language description; lexical analysis; syntax analysis; semantic analysis/code generation; interpretation/program execution. Programming Languages: a comparative study.

6.606 Computing Science Honours

6.607A Computer Hardware Architecture **S1 L3T2**

Prerequisites: 6.602A, 6.602B, 6.602C, 6.602D at an acceptable level. Excluded: 6.612, 6.622.

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 at an acceptable level. Excluded: 6.612, 6.622.

A selection of topics from a list which normally includes Artificial Intelligence, Program Vertification, High Speed Calculation of Mathematical Functions, Computer Graphics.

6.612 Computer Systems Engineering **SS L2T3**

Prerequisites: 6.021E or 6.602A.

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.

6.622 Computer Application and Software **SS L2T3**

Prerequisite: 6.601A.

Topics chosen from the following: simulation, heuristics, numerical analysis, mathematical optimization, data structures, machine organization, high-level languages, compilers and operating systems.

6.801 Electrical Engineering **F L1T2**

Consists of 6.851 and 6.852.

6.822 Electronics for Distance Measurement **SS L1T2**

Prerequisite: 1.971.

A user-oriented introduction to the electronic principles which form the bases of electromagnetic distance measurement. Provides a basis of circuit theory and elementary electronics and then considers distance measurement systems. Includes an applications-oriented interdisciplinary project.

6.831 Chemical Instrumentation S1 L1T2

Prerequisite: 1.001.

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.

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.

Also known as 1.922 Electronics.

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, their interface with the prime power supply protection, electrical safety and compliance with Australian standards. Includes an applications-oriented interdisciplinary project.

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

Compound semiconductor physics and its engineering applications to Transferred-Electron Devices, Microwave MESFET's, GaAs MOSFET's, and GaAs integrated circuits. Review of recent technological developments, including fine-line techniques, ion-implantation, and anodic oxide growth, which have made these advanced devices possible.

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.

6.071G 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 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 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.

6.160G 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 Radiators and Applications C3

A selection of the following topics: review of basic theory. Adaptive arrays. Monopulse radar. Radiotelescopes — primary radiator design. Tolerance theory.

6.166G Wave Propagation Theory C3

Topics may include: introduction to propagation theory. Propagation over earth's surface. Propagation in a plasma. Ionospheric propagation, scatter propagation.

6.167G Microwave Transmission Theory C3

A selection of topics from: transmission lines, waveguides, microstrip and striplines, surface waves, resonant and periodic structures, long haul guided propagation, wave propagation in anisotropic media and the application of wave theory to millimetric and optical waves.

6.169G Microwave Circuits: Theory and Techniques C3

The theory and design of microwave circuits including a selection from waveguide circuit elements, multiport structures, cavities, filters and the symmetry properties of waveguide junctions. Microwave measurement techniques and applications.

6.170G Microwave Electronics C3

A selection of topics covering the principles and application of electron beam and solid-state microwave devices. These include klystrons, travelling wave tubes, backward wave tubes, crossed-field devices, parametric devices, high frequency diodes and transistors, Gunn-effect and IMPATT-type devices.

6.171G Network Synthesis C3

A course in passive network synthesis leading on from the circuit theory of current undergraduate courses. Emphasis is placed on the classical realizations and modern filters.

6.172G Advanced Network Synthesis C3

Further work in passive network synthesis with more attention to the approximation problem in the frequency domain and including some work on time domain synthesis.

6.224G Electrical Insulation Engineering 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 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 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 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, diakoptics. Load flow: problem definition, methods of solution. Short circuit analysis. Stability analysis: steady state and transient.

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 **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 6.150G.

6.251G Power Elective II **C3**

As for 6.150G.

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 Transmission **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.

6.341G Signal Analysis and Transmission through Networks and Systems **C3**

Revision of Fourier methods. Signal analysis in time, frequency and mixed domains. Correlation, convolution and analysis of system characteristics. Noise and properties of stochastic signals. Signals in communication systems.

6.342G Information and Communication Theory **C3**

Theory of discrete channels and systems. Theory or coding for discrete sources. Properties of languages. Continuous communication channels. Capacity of communication systems. Application of information theory to engineering systems.

6.343G Modulation Theory and Application to Systems **C3**

Modulation theory including modulation, frequency modulation and other analog modulation methods. Sampling. Pulse and digital modulation schemes, with particular reference to PCM. Comparative analysis or modulation methods and communication systems.

6.344G Optimal Design of Communication Systems **C3**

Theory of optimal filtering according to Wiener and others. Decision theory, leading to a discussion of optimal receivers for extracting signals from noise (detection and estimation). Optimal signal design. Joint optimization of signal and receiver.

6.345G Active and Adaptive Circuits for Integrated Systems **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.

6.346G Acoustics **C3**

Electrical, mechanical and acoustical analogies. Velocity of propagation of acoustical energy. Transducers, architectural acoustics. The ear, noise measurement and reduction. Sound as a means of communication.

6.347G Digital Communication Systems **C3**

Topics selected from: techniques for converting information into digital form; data transmission; data transmission and telephone networks; computers and communication; control of information flow, storage and coding; switching and protocols; network topology; routing; hierarchy; high-speed digital communication; systems in development stage; future systems.

6.350G Solid State Electronics Elective **C3**

As for 6.150G.

Offered in 1978 by Dr J. Richards, under this subject number.

Periodically Parametric Systems: A unified treatment of systems which have parameters which vary with time or with some other independent variable, aimed at developing practically-oriented mathematical skills for handling the wide-ranging systems of this type encountered in nature and in technology, and at applying these skills to elucidate properties of the systems.

6.373G Semiconductor Devices **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 **C3**

An account of the modern planar technology of seminconductor device and integrated circuit fabrication.

6.376G Reliability Engineering **C3**

Principles and applications of the reliability engineering concept, with particular reference to electronic components and systems.

6.377G Integrated Circuit Design **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.

6.381G Biology and Physiology for Engineers **C3**

Attempts to bridge the language barrier between biology and engineering. Some of the problems and techniques of biology and medicine which may be encountered by the biomedical engineer. Cells, tissues and organs, with emphasis on their system, function and characteristics.

6.382G Biomedical Engineering **C3**

Includes instruction in the specialized measurement techniques and instrumentation required in biomedicine. Emphasis on signal processing and control system analysis as examples of the application of engineering to biomedicine.

6.452G Principles of Feedback Control **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 Optimization in Systems Engineering **C3**

The fundamentals of optimization as used in Systems and Control. Topics covered include: constrained and unconstrained minimization of functions; review of search techniques; prinicple of optimality; dynamic programming; Hamilton Jacobi Bellman equations; calculus of variations; Pontryagin Maximum Principle; two point boundary value problem; linear quadratic problem. Time optimal control; state and control constraints; numerical methods.

6.455G Systems Identification and Modelling **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 Systems Theory **C3**

Provides advanced systems concepts relevant to both engineered and natural sensory systems, including a review of fundamental concepts relevant to Cybernetic Engineering, the genesis of cybernetics, coding, learning and neural networks. Special topics treated include: the Perceptron, subsystems of the human brain and 'functional' descriptions of a 'Cybernetic Brain' and an approach towards industrial robots with reference to their social implications.

6.458G Pattern Recognition Systems **C3**

Basic concepts and methods in mathematical pattern recognition and an in-depth study of both nonparametric and parametric methods. Includes such topics as: pattern, feature and classification spaces: feature selection; linear discriminant functions and linearly separable training algorithms; piece-wise discriminant functions; decision rules; the Bayes framework, approximation of probability densities; clustering and dimensionality reduction.

6.459G Control Computing **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 **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.

6.461G Large Scale Systems **C3**

The special problems in modelling and controlling large scale systems, including numerical problems. Modelling topics include: modelling of large-scale static and dynamic systems; flow-network analysis; solution of large networks by tearing; linear programming using sparsity and other techniques; soluton of large sets of normal equations.

Control topics include; multilevel approaches to the control of large-scale systems; simplification of models; aggregation method; pole-shifting techniques for multivariable modal control.

6.464G Stochastic Processes in Automatic Control **C3**

This subject reflects the non-deterministic nature of many control problems. Topics include: random variables and distribution; random processes; Gaussian and Markov processes. Processing of processes through linear systems; correlation functions. Spectral theory; Weiner and Kalman filtering. Least squares estimation; the stochastic regulator problem and separation theorem.

6.466G Advanced Linear Control Theory **C3**

An in-depth treatment of the mathematical theory of lumped linear systems. Topics include: linear differential equations. Linear algebra and functions, periodic equations. McMillan degree, realizations. Observer theory; general compensator systems including Kalman filter; theory of optimal linear regulator. Stability definitions, criteria and tests; Popov and Lyapunov methods. Decoupling; pole positioning.

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.

6.650G Computer Science Elective **C3**

As for 6.150G.

6.651G Digital Electronics **C3**

Digital circuits and principles, sub-system organization, microprocessors, memory technology, interface design, graphics, display systems.

6.654G Switching Theory and Digital Systems **C3**

Analysis and design of three different types of sequential circuit; clocked sequential, pulse-mode sequential, and fundamental-mode sequential circuits. Applications to the design of digital computer circuits. Error correcting and detecting binary codes. Linear sequential feedback circuits.

6.655G Computer Organization and Architecture **C3**

Number systems and computer arithmetic — storage, control, input/output. System organization.

6.656G Software Systems A **C3**

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 problem of moving software systems between different mechanics. Compiler compilers: translator writing systems designed to provide facilities to aid the compiler writer.

6.657G Software Systems B **C3**

Overview of operating systems, sequential processes, concurrent processes, processor management, store management, scheduling algorithms, resource protection, data communication case studies.

6.909G Project **C9**

6.918G Research Project **C18**

6.936G Research Project **C36**

School of Civil Engineering

Undergraduate Study

8.001 Industrial Training

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 prior to enrolment in the final year.

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 Projects Year IV — SS L0T3

Equal to one technical elective.

A minor thesis or research project on any approved topic.

8.012 Elements of Architecture — SS L2T1

Prerequisite: 8.672.

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

Not compatible with 8.019. Prerequisites: 8.174, 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. Co-requisite: 8.191.

Revision of fundamentals of FORTRAN (including WATFOR, WATFIV), programming and some advanced techniques such as the use of tapes, discs, etc, and plotting. Introduction to APL programming and Basic Language for Wang mini-computer. Development of some numerical techniques for programming. Applications to problems in structural analysis, geomechanics and water engineering.

8.015 Road Engineering — SS L2T1

Prerequisites: 8.272, 8.671, 29.441.

Planning, location and design of roads in urban and rural areas. Properties of bitumen and pavement design. Computer applications and the use of aerial photographs in road design.

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

Prerequisite: 8.672.

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

Prerequisite: 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

Not compatible with 8.013. Prerequisite: 8.672.

First half of subject consists of the Session 1 lectures and tutorials of the Bridge Engineering elective, the second half is devoted to railway engineering. It includes railway geometry, track rails, traffic, railway development.

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 — SSL2T1

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**

Prerequisites: 8.571, 10.022.

Equations of continuity, motion and vorticity; Φ and ψ functions, Laplace equation, standard flow patterns; practical applications.

8.024 Foundation and Dam Engineering **SS L2T1**

Prerequisite: 8.273.

Foundations of structures and dams. Problems. Alternative foundation types. Treatment of foundation soils. 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: 8.301.

The development of models for the definition, design, and control of engineering problems in construction project management. Influence of decision level on systems model formulation. Case study approach coupled with field investigations and group projects. All students are required to visit a nominated field site as an integral part of the subject.

8.027 New Materials I **SS L2T1**

Prerequisite: 8.272. Co-requisite: 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**

Prerequisites: 8.273, 8.182.

Theory and application of fibre reinforcements — glass and steel fibre reinforced cements, mortars and concrete composites. Shrinkage compensated and expansive cements — 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**

Pre- or co-requisite: 8.672.

Civil Engineering Construction organization, management and control.

8.031 Construction Project Finance **SS L2T1**

Pre- or 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**

Pre- or 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**

Pre- or co-requisite: 8.673.

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; analysis and design of flat plates and flat slabs; design for torsion, deep beams and corbels; lateral load analysis of concrete building; water-retaining structures; and a topic of general interest (suggested by students).

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**

Co-requisite: 8.272.

Introduction to structural geology rock types. Macro and Micro characteristics base studies. 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**

Prerequisite: 8.582.

Resource systems approach to the problem of matching, by means of engineering works, the supply of water and the demand for water.

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.

8.046 Town Planning **SS L2T1**

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.

8.047 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

Prerequisites: 8.572, 8.581, 8.582.

Final year design project in the field of hydraulics and water resources.

8.054 Design Project — Construction

Final year design project in the field of engineering construction and management.

8.055 Applied Structural Analysis **SS L2T1**

Prerequisite: 8.174.

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 minicomputer, terminals and commercial programs).

8.056 Practical Structural Design **SS L2T1**

Prerequisite: 8.182.

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**

Prerequisite: 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: 8.182.

Importance of structural dynamics in civil engineering; earthquake effects and design requirements in buildings and other structures; wind loads on structures. Review of basic methods in dynamic analysis, with structural applications.

8.060 Numerical Methods in Geotechnology **SS L2T1**

Prerequisite: 8.272.

Introduction to finite element method; mathematical formulation on the basis of the theories of elasticity and plasticity; application of these formulations 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.

8.112 Structures **S1 L1T2**

Theory of Structures — Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strain. Relationship between load shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment shear force, and

torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

8.113 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.

This subject forms part of 5.020 Engineering B.

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 — FL1T2

Prerequisite: 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

Prerequisite: 8.182. Pre- or co-requisite: 8.174.

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.

8.250 Properties of Materials — SS L2T2

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.

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**

Prerequisite: 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, use as a structural material. Mechanical properties, anisotropy, seasoning and preservation. Grading and basic working stresses. Welding, classification of processes. Characteristics of welds and weld metal. Heat-affected zones and thermal history. Geometrical and property defects, distortion. 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: 8.273.
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 deterioration, permeability. Non-destructive testing.

8.301 Systems Engineering **F L1T1**

Prerequisite: 10.001.

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**

Prerequisite: 8.171.

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.

8.581 Water Resources I **SS L1½T1½**

Prerequisite: 8.571.

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**

Prerequisite: 8.571.

The hydrologic cycle, water and energy balances, climatology, atmospheric moisture, precipitation, runoff cycle, infiltration, stream gauging, hydrograph analysis, storm runoff and loss rates, design storms, flood estimation, yield and storage determination, groundwater.

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: 8.001.

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.

8.713 Management for Surveyors **SS L2T0**

General introduction to business and management for surveyors. Government and private project planning and scheduling. Investment and financial aspects of business, office management. Legal aspects of professional practice.

Graduate Study

8.701G Decision Making in Civil Engineering **C3**

Decision theory, game theory, multiple objective planning, micro-economic theory, objectives and criteria, benefit/cost analysis, bidding applications.

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, dynamic 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, coffer-dams, 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 surfacings: 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 practice and theory. Bituminous soil stabilization: concrete pavement mixtures, reinforcement, and placement. Concrete-bitumen mixtures. Reinforcement materials for pavements. Bituminized membranes. Quality control and performance of bituminous and concrete pavement materials.

8.750G Pavement Design and Evaluation I C3

Pavement types for road, rail, airfield and other works: Stress distribution in pavements, theoretical and actual: subgrade 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 C3

Basic geology, geological processes, civil engineering applications, photo interpretation, ground surveying.

8.753G Soil Mechanics I C3

Soil pedology, fabric studies, unsaturated soils, transient water flow in soils.

8.754G Soil Mechanics II C3

Failure theories, natural and stabilized soils, plastic equilibrium and general stability problems in soil masses. Application of statistics.

8.755G Materials of Constructions I C3

Concrete significance of tests and characteristics of constituent materials, target strength, mix design theories, workability, elastic properties, creep and shrinkage.

8.756G Materials of Construction II C3

Metals: evaluation and acceptance tests, relaxation, fatigue, ductility and brittle fracture, structural alloys. Timber and plastics: mechanical and physical properties. Adhesives, laminates, elastomers, development of plastics for construction purposes.

8.758G Soil Mechanics III **C3**

Stability of man made and natural slopes. Static and earthquake analyses. Earth and rockfill dams. Dynamic behaviour of soils. Case studies.

8.759G Rock Mechanics **C6**

Elasticity and plasticity analyses for rock masses, discontinues strength and deformation of rocks, failure theories, an isotropy, creep in rock masses, permeability of rock masses, water flow in rock masses.

8.760G Materials of Construction III **C3**

Concrete as a structural material. Strength and failure mechanism, crack propagation, bond with steel and cracking of reinforced members. Fatigue and durability of reinforced and prestressed concrete. Non-destructive testing. Recent developments and 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.

8.768G Fracture Mechanics **C3**

Theories of fracture, failure modes, cleavage. Ductile fracture, plastic deformation, brittle fracture, crack propagation, and arrest, energy releases. Ceramics, silicates, rocks, polymers.

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.

8.802G 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 formulation 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 various degrees of freedom. Vibration in beams and other continuous structures.

8.805G Vibrations 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.

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. 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.

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 multistorey buildings.

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. Basis of finite elements: Principle 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 element 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. Cavitation in conduits, transport of water borne mixtures in pipes, accuracy of flow measurements 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, atmospheric moisture, precipitation process, precipitation analysis, evaporation and transpiration, storm runoff process, interception, infiltration curves, land use and management, instruments.

8.838G Hydrological Design C3

Steam gauging, hydrography analysis, storm runoff, loss rates, flood estimation, rational method, unitgraphs, flood frequency, storage-yield analysis.

8.839G Advanced Methods of Flood Estimation C3

Flood routing, catchment characteristics, runoff routing, synthetic unitgraphs, urban drainage, regional empirical flood estimation methods.

8.840G Hydrological Models and Data Synthesis C3

Hydrological systems and models, deterministic catchment models, stochastic hydrology, storage-yield, probability of failure, storm models and extreme precipitation, hydrograph models and unitgraph derivation.

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 Resources 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

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.

8.855G 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.

In 1978 it is proposed to offer a subject in the field of construction labour and field management relations.

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.

Topic for 1978: *Construction Contract Administration:* Objectives of construction contracts. Types and usages of contract documents. Selection of tenderers. Powers and duties of the engineer. Contract variations and extensions of time. Site management by the contractor. Measurement and payment of progress claims. Management of sub-contracts. Latent conditions. Liquidated damages. Provision for the settlement of disputes. Arbitration procedures. Case studies and comparisons of contract conditions.

8.909G Project **C9**

8.918G Research Project **C18**

Department of Industrial Engineering

Undergraduate Study

18.011 Industrial Engineering 1A **F L1¼T¾**

Prerequisite: 10.022. Co- or prerequisites: 5.071, 5.111.

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, 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.

18.021 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, interrelationships and information flow. Application of data processing and control systems. Introduction to inventory control. Analysis of some engineering planning decisions. Sampling techniques in quality control. Control charts. Further quantitative work.

18.061 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.

18.121 Production Management **F L3T0**

Prerequisites: 10.031, 10.331.

Engineering Economy: Economic objectives of the firm. Economic measures of performance: net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment.

The Use of Human and Physical Resources: Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout.

Production and Quality Control: Control of jobbing, repetitive batch and continuous production. Manufacturing organizations, functions, inter-relationships and information flow. Introduction to inventory control. Analysis of some engineering planning decisions.

Introduction to operations Research: The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

18.431 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. Jig, fixture 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, design of measuring systems, measurement errors, theory of inspection.

18.432 Design for Production Systems — F L2T4 (Project)

Prerequisites: 5.071, 18.011, 18.021.

This subject may be taken only by potential graduates.
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.

18.551 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.

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.

18.080G 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 χ^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.

18.271G 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 multi-point tools; prediction of cutting forces, temperature, stresses.

18.272G Technology of Machining and Forming Processes **C3**

Selected topics from: Machine tool vibration; design 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.

18.371G 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, pre-determined 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 simplification 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.

18.471G Design Communication **C2**

Communication system in design; aids to design communication; engineering drawing practice; standardization; interpretation of design information.

18.472G Engineering and Design Analysis **C6**

Error analysis in design; economic tolerance selection; probabilistic tolerancing; case studies using industrial design.

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.

18.580G 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.

18.680G 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 and their application to solving realistic problems.

18.681G Engineering Economic Analysis **C3**

Price-output decision 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, natural resource utilization and probability. Quality.

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**

Not available in 1978.

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-relationships 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.

18.871G 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 mathematics 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 restraints; 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.

18.909G 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

School of Nuclear Engineering

Undergraduate Study

23.051 Nuclear Power Technology L2½T½

Nuclear processes, reaction rates, fission and energy release. Neutron multiplication, slowing down and diffusion. Nuclear reactor criticality and burnup, neutron kinetics and reactor control.

Thermal and fast reactor types, operation, environmental and safety aspects. Nuclear fuel enrichment and utilization, nuclear power costing and economics.

Heat generation and removal, fluid dynamics and heat transfer aspects of gas and liquid coolants, boiling, two phase flow and burnout. Structural mechanics in reactor technology, thermo-mechanical performance of fuel pins and pressure vessels.

Graduate Study

23.013G Neutron Transport and Diffusion 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 C3

The derivation and use of fewgroup reactor models for the macroscopic analysis of finite reactor criticality, burnup and control.

*Subjects which allow the presentation of special topics, particularly by visiting academics.

23.015G Multigroup Reactor Theories **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 **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 **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 **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 **C3**

A study of the 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 **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 **C3**

The special problems associated with the dynamics and stability of fluid cooled reactors under boiling conditions.

23.028G Reactor Accident and Safety Analysis **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 **C3**

Mathematical methods, partial differential equations, special functions, and numerical methods for digital computation, relevant to Nuclear Engineering.

23.033G Matrix Theory and Computation **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 **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 **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 **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 **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 **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 **C9**

23.918G Research Project **C18**

23.936G Research Project **C36**

School of 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.

24.001G Human Factors In Transport **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 **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 **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 **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 **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 **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) **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) **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 **C3**

Central projection theory and application to alignment design; perspective drawing methods, introduction to aerial and terrestrial photogrammetry, photomaps and photomontage as applied to transport facilities. Speed change lanes, exit and entrance terminals, ramp types, ramp speeds and design. Interchange location and layout, provision for surface water, signposting. Computer use. Safety measures during maintenance.

24.010G Highway Engineering Practice Part 1 **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 2 **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 **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 **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 1 **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 2 **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 **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 **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 1 **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 2 **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 **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 **C3**

The law relating to the planning and construction of roads and highways and associated works, transport law and regulations, commonwealth, state and local government responsibilities. Relevant sections of acts and ordinances.

24.022G Pavement Materials I **C3**

As for 8.748G Pavement Materials I.

24.023G Pavement Materials II **C3**

As for 8.749G Pavement Materials II.

24.024G Pavement Design and Evaluation I **C3**

As for 8.750G Pavement Design and Evaluation I.

24.025G Pavement Design and Evaluation II **C3**

As for 8.751G Pavement Design and Evaluation II.

24.026G Bridges and Highway Structure Part I **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 **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 **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.

24.101G Characteristics of Transport

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 **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 **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 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 C6

Generation of traffic, estimation of traffic growth and assignment of traffic to competing traveling modes. Land use and transport interaction.

24.106G Traffic Operation and Control 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 C8

Nature and origins of soil. Site investigation, sampling and in-situ testing techniques. Soil classification and its engineering significance. Failure criteria for soils. Stress-strain properties of soils. Consolidation and settlement, improvement of weak soils. Bearing capacity. Movement of water in saturated and unsaturated soils. Design of embankments, slopes and cuttings. Design of earth retaining structures. Foundations for highway structures.

Compaction and soil stabilization. Material specifications. Soil water potential under covered areas. Climatic and topographical factors. Traffic factors. Distribution of wheel loads in layered systems. Response of pavement materials to traffic loading. Design methods for flexible and rigid pavements and overlays for highways and airfields. Evaluation of pavement serviceability.

24.108G Road Engineering Practice C8

Bituminous Construction: Standard tests for bitumens and tars. Theoretical design of bituminous concrete mixes. The importance of air voids and analysis of constituents of bituminous concrete. Grading of aggregates. Tests for road aggregates. Method of bituminous mix design. The Hubbard Field method of bituminous mix design. The Hveem method of bituminous mix design. Difficulties inherent in stability testing. Determination of the proportions of the constituents of a sample of bituminous road material. The forms of road bitumens. Straight run bitumens. Cutback bitumens. Bituminous emulsions. Open textured bituminous macadam. Dense mix. Surface dressing. The weathering of bitumen.

Highway Law: Highway Law, the law of contracts, definition of a contract, five necessary elements for a valid contract. Operation and interpretation, fundamental principles and established practice, time for performance, discharge or dissolution, remedies for breach of contract, variations. Powers and duties of the engineer, agency, commercial arbitration, approvals, scope of obligations and authority, both legal and ethical, related contracts, carriage of goods by land, insurance, master and servant (contracts of employment), sale of goods, arbitration act.

Contract Documents: Engineering contracts, types of contract, contract documents, general conditions of contract, drawings, specification, schedule or Bill of Quantities, tenders, letter of acceptance, the agreement, mechanics of execution of a contract, contract law in other countries. Specifications, purpose and relationship to other contract documents, principles of specification writing, basic layout, method of approach and composition, bills of quantities, purpose and relationship to other contract documents, methods of presentation, principles of preparation and standard procedures, units.

Critical Path Planning and Use of Computers in Highway Engineering: Need for construction planning. Introduction to Operations Research. The Critical Path Method, PERT. Use of CPM and PERT in planning, control and supervision. Problem oriented computer languages for CPM and PERT (ICES-PROJECT). Introduction to computers and programming.

Aggregates: Types of aggregates, properties of aggregates, review of available tests, difficulties of testing, relationship between results of arbitrary and fundamental tests, effect of various factors on the result obtained with Los Angeles and aggregate crushing tests, importance and determination of surface texture of aggregate, crushing and preparation of aggregate and factors affecting particle shape, importance of free silica content in crushing, presence of secondary minerals and other factors affecting durability, alkali aggregate reaction, proportioning (blending) aggregates.

Quarrying and Plant Selection: Acquisition and administration of plant. Estimating plant productivity: Estimating plant cost. Quarrying, crushing and screening.

24.109G Road Location and Design — Part I 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 C7

Traffic Engineering: Traffic measurements, relation between flow and concentration, speed, sampling, headway distributions and gap acceptance, delays to conflicting streams, car following behaviour, traffic signals (isolated and linked), street lighting, accident studies and traffic control warrants. *Photogrammetry:* Drawing office methods of photo measurement and interpretation, radial line plotting, parallax bar measurements, controlled mosaic assembly.

Town Planning and Landscape Architecture: Analysis of the 20th century town, principles of land use zoning, planning for traffic and transport, public open spaces, the planning of residential areas, planning for industry, visual quality of urban and rural environment, the city centre, vegetation and environment, plant materials, principles of landscape design, examples of landscape design, street and roadside planting, urban sociology.

Hydrology: Urban drainage design, hydraulic design of highway structures, introduction to run off process and estimates, review of and discussion of the theoretical basis for the most important existing methods of calculating culvert and gully sizes.

24.111G Road Construction **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 **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 exposives, 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.

24.909G Project **C9**

24.918G Research Project **C18**

24.936G Research Project **C36**

School of 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 IA **SS L3T2½**

The scope and purpose of surveying. Instruments and methods. Theory and practice of data reduction. Levelling. Plane table surveying. Linear measurement. Angular measurement. Detail surveys. Traversing. Aspects of the history of surveying.

29.002 Surveying IB **SS L1T5½**

Tacheometric surveys: calculation, plotting and contouring. Minor instruments. Surveying project embodying the selection of instruments and the design and application of field procedures. Introduction to plotting and plan drawing.

29.011 Surveying IIA **S1 L1½T3**

Plane triangulation, trigonometrical heighting, barometric heighting, tacheometry.

29.012 Surveying IIB **S2 L1T3½**

Engineering surveys, curves, volumes. Survey errors, adjustment of instruments.

29.103 Surveying III **SS L4T3**

Electronic distance measurement, gyrotheodolites, compensators in levels and theodolites. Optical plumbing, deflection and settlement measurements, survey methods in industry, mine surveying. Gauss collimation technique, map reproduction, methods of preparation and reproduction of line maps. Other types of maps. Tape standardization, laboratory testing of instruments, error analysis in survey methods. Precision of formulae. Integrated surveys in general. Relocation of lost marks. special problems.

29.151 Survey Computations I **SS L3½T2½**

Use of tables. Plane trigonometrical formulae. Calculation of triangles, areas, roadways, sub-divisions and curves. The use of calculators. Traverse computations including offsets and missing data problems. Areas from co-ordinates. Transformations. Spherical trigonometry and its application to survey problems. Resections and intersections: mathematical and semigraphic methods. Elementary programming for electronic computers.

29.152 Survey Computations II **SS L2T1**

Revision of basic error theory. Adjustment by least squares 1. parametric method; 2. method of correlatives. Solution of Normal Equations by elimination methods 1. Gauss-Doolittle; 2. Cholesky. Error ellipse calculations.

29.161 Hydrographic Surveying I **SS L1T1**

Principles, objectives, equipment and methods of hydrographic surveying.

29.162 Hydrographic Surveying II **SS L2T1**

Advanced techniques of hydrographic surveying, theory and applications. Tidal measurements and analysis.

29.173 Project **S2**

An elective project involving investigation of an assigned topic.

29.182 Cartography Elective **SS L1T1**

Mathematical cartography: map projections, Transverse Mercator, UTM and ISG. Topographic cartography: representation of features, toponymy, map series. Thematic cartography. History of cartography.

29.183 Cartography Advanced Elective **SS L1½T1½**

Cartographic Technology: Drawing techniques, scribing techniques, type and symbols, photomechanical methods, screens and masks, colour registration, proofing methods, principles of lithography. Automation of cartographic techniques. Planning and organization.

29.191 Survey Camp

A one-week field camp, including the preparation of a report and plans.

29.192 Survey Camp

A one-week field camp, including the preparation of a report and plans.

29.193 Professional Training

A five-month period of practical experience including the submission of a report.

In special circumstances, a five-week practical project, supervised by the School, may be substituted. The project is equivalent to 160 contact hours.

29.194 Survey Camp

A two-week field camp followed by two weeks on campus for completion of computations.

29.211 Geodesy I **SS L4T2 or F L2T1**

Historical development of geodesy. The spheroid; curves on the spheroid. Legendres Theorem, computation of geographical co-ordinates. Geodetic surveying (types of horizontal control surveys). Procedures for angular observation. Surveyors projections. Applications to integrated surveys. Precise levelling.

29.212 Geodesy II **SS L2T1**

A. Adjustment of control surveys using the condition and parametric methods of least square adjustment for measured angular and linear quantities. Variance/covariance matrix: variance factor; weight coefficient matrix. Elementary statistical testing of observations and adjusted values.

B. Relationship between geoid and ellipsoid; astro geodetic levelling; ellipsoidal elevations; mean sea level and the geoid. Methods for establishing a world geodetic system. Gravity and its use in geodesy.

29.213 Geodesy III **SS L2T1**

Topics selected from: Calculations on the ellipsoid. The conformal projection of an ellipsoid. Atmospheric refraction and its effect on survey measurements. Adjustment of control surveys, precision of adjustment measurements, error ellipses of adjusted co-ordinates. The time variation of geodetic position. Long range goals of geodesy. Seminar.

29.311 Astronomy I **SS L2T1**

The celestial sphere and the astronomical triangle. Definitions, conventions and time. Latitude by circum-meridian and longitude by extra meridian methods. Best position, balancing. Introduction to azimuth determination.

29.312 Astronomy II **SS L2T1**

Azimuth by circum-elongation, circum-polar and sun observations. Optimum position of observation, balancing of observations. Position line methods.

29.313 Astronomy III **SS L2T1**

A study of topics selected from the following: Corrections to observations and calculations; star co-ordinates; meridian methods; equal altitude methods; precise timing.

29.411 Surveying for Architects and Builders **SS L1T1½**

Introduction. Chaining, methods of measurement, corrections, chain surveys. Level, differential levelling. Contours, volumes of earthworks. Theodolite, methods of reading angles, applications in building. Traversing, setting out.

29.431 Surveying and Cartography **SS L2T2½**

History of surveying and its relationship with town planning. Types of survey, methods of measurement, corrections, chain surveys. Level, differential levelling. Contours, volumes of earthworks. Theodolite, applications in building. Traversing, setting out. Basic concepts of land tenure, land registration and cadastral surveying. Outline of photogrammetry. Cartography. Plotting. Preparation of plans, methods of enlargement and reduction, plan registration. Measurement of areas by planimeter.

29.441 Surveying for Engineers **SS L2T4**

Part A. Ordinary levelling. Angle measurement. Linear measurement (bands). Theodolite traversing. Tacheometry. Contour and detail surveys, areas and volumes.

Part B. Levelling (other methods). Linear measurement (electronic). Applications of survey techniques: control surveys, provision of information for design, setting out engineering works, etc. Outline of photogrammetry.

29.491 Survey Camp

A one-week field camp.

29.511 Photogrammetry I **SS L3T3**

Stereoscopic vision, geometry of single photograph and stereoscopic pairs. Fundamentals of interior, relative and absolute orientation. Radial triangulation simple mapping methods. Cameras and physical properties of photographs. Photogrammetric control selection.

29.512 Photogrammetry II **SS L1½T1½**

Fundamental mathematical relationships. Basic design principles and practical applications of plotting instruments. Methods of aerial triangulation. Map compilation. Flight and project planning.

29.513 Photogrammetry III **SS L1½T1½**

Introduction to analytical photogrammetry. Independent model triangulation procedures. Propagation of errors in aerial strip triangulation. Concepts of strip and block adjustment. Mosaics, rectification, orthophotography. Camera calibration, 'non-metric' cameras.

29.621 Land Development I **S1 L3T1**

1. Land development in New South Wales. Feasibility studies. Costing to determine economic viability. Initial investigation of road layout and lot sizes. Local council and statutory bodies. Land development law. Fundamentals of subdivision design. Contracts, setting out, supervision. Final preparation and lodgement of plan. **2.** Land in economic theory. Population pressure, demand for land. Factors affecting the use of land. Urban land use. Rent theory. Land value and the land market. Rural-urban land conversion. Valuation methods. Patterns of value. Subdivisional value of land.

29.622 Land Development II **S2 L1T2**

A project involving the preliminary survey, analysis and all aspects of design for a development. Detailed costing and feasibility report.

29.623 Land Development III **S2 L2T1**

Land and environment. Environmental impact assessment. Cost benefit analysis. Use of McHarg maps. Government environmental policy and procedures. Computers and design. Operations research, application to control and costing of land development projects. Discounted cash flow. Analysis of a major project.

29.631 Land Inventory I **S1 L1½T1½**

Maps and models. Maps and their users. Resources surveys. Sampling, accuracy. Overlay maps. Spatially interacting variables. Data collection from aerial photographs. The Integrated survey system. Introduction to land data banks.

29.632 Land Inventory II **S2 L2T1**

Land data banks. Geocoding. Alternative referencing methods. Remote sensor input to spatial information systems. Application to environmental data. Modes of information output. Alternative modelling techniques.

29.641 Land Law and Tenure I **S2 L2T0**

The Legal System. Land tenure and property law. Torrens system. Role of cadastral surveyor. Boundary law in NSW. Survey investigation. Statutes and regulations. Searching. NSW Integrated survey system: legal implications.

29.642 Land Law and Tenure II **S2 L2T1**

Development, principles of land registration. Torrens system: detailed examination. Land tenure systems throughout the world. The modern cadastre. General and fixed boundaries. Co-ordinates versus monuments.

Graduate Study

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.

29.154G Adjustment of Observations **C6**

Choice of the mathematical model. Transformation of the model. Variance/covariance matrix for the observations. Variance factor. Weight of coefficient matrix. Condition method of least squares. Parametric method of adjustment. Statistical tests for the adjustment. Precision of adjusted variates. Error ellipses. Optimization of control surveys. Adjustment in phases. Parametric adjustment with conditions between the observations. Parametric adjustment with conditions between the parameters. Adjustment of minor order control to major control by means of transformations.

29.163G Mathematical Methods I — Numerical Analysis **C3**

Finite and divided differences, interpolation formulae, curve fitting. Computational error analysis. Quadrature, numerical integration. Orthogonal polynomials. Fourier analysis. Exponential approximations. Iterative solutions of large blocks of linear equations.

29.164G Mathematical Methods II — Statistics of Observations **C3**

Advanced applications to survey observations and least square adjustments of frequency distributions, variance, minimum variance, unbiased estimation, central limit theorem, multivariate distributions and statistical testing.

29.165G Mathematical Methods III — Ellipsoidal Harmonics C3

Vector theorems. Theory of spherical and ellipsoidal harmonics.

29.215G Geometrical Geodesy C3

Geometry of the ellipsoid. Calculation of geodesics and normal sections of the spheroid: various solutions and their merits. Computation in three dimensions. Atmospheric refraction: wave propagation in a heterogeneous medium, physics of lower atmosphere, calculation of corrections.

29.216G Geodetic Surveying C3

Review of methods of geodetic surveying. Electronic distance measurement, angle measurement, characteristics of instruments, corrections to observations. Principles of satellite triangulation.

29.223G Dynamic Geodesy C3

Orbital motion of near earth satellites; the analysis of satellite orbits for low degree harmonics of the earth's gravitational field; the application of results at the surface of the earth.

29.224G Physical Geodesy C6

Fundamental equations for the solution of the boundary value problem; telluroid; solutions to the order of the flattening. The gravitational field of the rotating spheroid. The analysis of gravity; extension techniques. Astro-geodetic levelling; comparison of gravimetric and astro-geodetic solutions. The determination of the earth's gravitational field from satellite orbital analysis. The combination of satellite and surface gravity data. Computational data.

29.314G Geodetic Astronomy 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 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 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 C3

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 C3

Theory of instruments: comparators, restitution instruments, approximate instruments, ancillary equipment. Testing and calibration of instruments.

29.520G Photogrammetric Production Process C3

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry. Digital terrain models.

29.521G Control Extension A C3

Prerequisite: 29.517G or consent of the instructor.

Early methods of photogrammetric control extension: radial triangulation, stereotemplets, bridging. Strip triangulation by picture connection in space. Method of independent bases. Independent models, perspective centre calibration. Graphic and numerical strip adjustment by polynomials. Analytical strip triangulation. Adjustment of blocks by iterated strip adjustment.

29.522G Control Extension B 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.

29.909G Project C9

See Graduate School of Engineering Handbook for details of research areas in the School.

29.918G Research Project C18

See Graduate School of Engineering Handbook for details of research areas in the School.

29.936G Research Project C36

See Graduate School of Engineering Handbook for details of research areas in the School.

Division of Postgraduate Extension Studies

Graduate Study

97.001G Linguistics and Written and Spoken Communication **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 examinations 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; preparation of a technical lecture.

97.002G Basic Information Theory **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.

97.004G The Psychology of Communication **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. Elementary statistics and statistical analyses in the experimental study of communication.

97.005G Audio and Video Equipment — Capabilities and Applications **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 **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 **C2**

Vocal organs. Phonation. Formant patterns of speech. Acoustic specifications of speech. Mechanism and characteristics of the ear. Mechanism and characteristics of the eye. Vision defects and illusions. The brain. Neurological signal transmission characteristics.

97.010G Basic Fortran **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 **C5**

97.013G Presentation of Information **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 97.005G (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).

Non-Engineering Subjects

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**

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.

The application of wave and particle theories in physics. A review of the atomic theory of matter and the structure and properties of atomic nuclei. 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 of principle.

1.011 Higher Physics I **F L3T3**

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**

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, electromagnetic 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**

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**

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**

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 quantities. 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**

Prerequisites: 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**

Prerequisites: 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) **F L1½T1½**

Prerequisites: 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 low 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

2111 Introductory Chemistry **S1 L2T4**

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**

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

2.131 Chemistry IB **S1 or S2 L2T4**

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

2.021 Chemistry IE **S1 or S2 L3T3**

A terminating subject for students in the Aeronautical, Civil, Electrical, Industrial, Mechanical and Mining Engineering, and Naval Architecture courses.

Classification of matter and theories of the structure of matter. Atomic and molecular structure, the periodic table and chemical behaviour. Chemical bonding and the nature and properties of chemical systems. Equilibrium and energy changes in chemical systems. Introduction to colloidal systems.

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**

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

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 applicatons. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials.

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

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

4.921 Materials Science **F L1T0**

The atomic structure of metals. The crystalline nature of metals and its significance. The solidification of metals. Plastic deformation of crystalline materials and its effect on properties. Phase equilibria in metallic alloys. The heat treatment of some ferrous and non-ferrous alloys. Corrosion. The electron theory of metals. Conductors, semi-conductors and insulators. Magnetic materials — structure and properties.

4.931 Metallurgy **SS L2T1**

For students of Civil Engineering. Part of 8.272 Civil Engineering Materials I.

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

4.941 Metallurgy for Engineers **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.

Mathematics

Undergraduate Study

10.001 Mathematics I **F L4T2**

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.011 Higher Mathematics I **F L4T2**

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.022 Engineering Mathematics II **F L2T2**

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.

10.033 Electrical Engineering Mathematics III F L1½T½

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 L1½T½

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 L1½T½

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.1114 Pure Mathematics II — Complex Analysis S2 L1½T½

Analytic functions, Taylor and Laurent series, integrals. Cauchy's Theorem, residues, evaluation of certain real integrals.

10.2111 Applied Mathematics II — Vector Calculus S1 L1½T½

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 L1½T½

Series solution of ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series, Bessel functions.

10.341 Statistics SU F L1T½

For students in the School of Surveying.

An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^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.

10.342A Statistics SU (Part A Sandwich course) L1T½

An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood.

10.342B Statistics Su (Part B Sandwich Course) S1 L1T½

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.

10.351 Statistics SM F L1T½

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, χ^2 and F. Estimation of parameters: the methods of moments and maximum likelihood and confidence interval estimation. The standard tests 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

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 χ^2 and t. 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, 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

Boundary value problems in partial differential equations. Selected topics from complex variable analysis, integral transforms and othogonal functions and polynomials.

10.062G Advanced Mathematics General

For research workers throughout the University requiring employment of advanced mathematics. Topics vary from year to year according to demand and interest.

10.361G Statistics

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

Revision of probability and distribution theory, including estimation and 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 L1½T0**

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 L1½T0**

Prerequisite: 14.001.

An introduction for non-commerce students to managerial accounting. Long-range planning, budgeting and responsibility accounting; cost determination, cost control and relevant cost analyses.

Economics

Industrial Relations

Undergraduate Study

15.501 Introduction to Industrial Relations

For students enrolled in Faculties other than Commerce and Arts. It is designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Topics covered include: the origins, evolution and operation of the Australian system of industrial relations; the structure and role of trade unions and employer bodies; the function of industrial tribunals such as the Australian Conciliation and Arbitration Commission and the N.S.W. Industrial Commission; wages structure and determination; employment, unemployment and retraining; the nature and causes of strikes and other forms of industrial conflict; the processes and procedures for conflict resolution.

Where appropriate to class composition, particular attention is paid to individual industries.

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.

Town Planning

Undergraduate Study

36.411 Town Planning **SS 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.

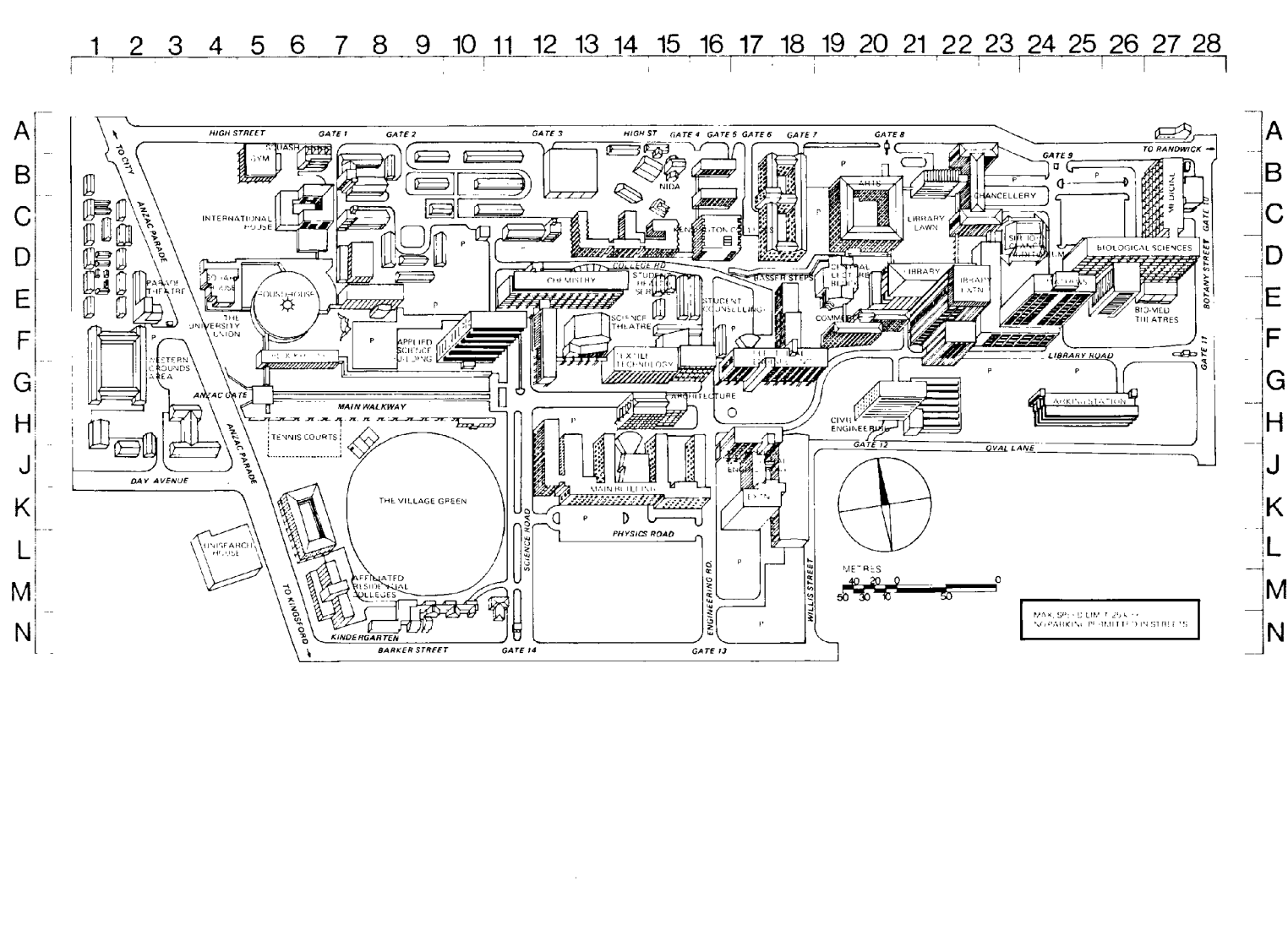
The University of New South Wales Kensington Campus 1978

Buildings

Applied Science F10
Architecture H14
Banks F22
Barker Street Gatehouse N11
Basser College C18
Biological Sciences D26
Biomedical Lecture Theatres E27
Central Lecture Block E19
Central Store B13
Chancellery C22
Civil Engineering H20
Classroom Block (Western Grounds) H3
Dalton (Chemistry) F12
Electrical Engineering G17
Electrical Engineering Theatre F17
Goldstein College D16
Golf House A27
Gymnasium B5
House at Pooh Corner N8
International House C6
John Goodsell (Commerce) F20
Keith Burrows Lecture Theatre H14
Kensington Colleges C17
Main Building K15
Maintenance Workshop B13
Mathews F23
Mathews Theatres D23
Mechanical and
Industrial Engineering J17
Medicine (Administration) B28
Menzies E21
Metallurgy E8
Morven Brown (Arts) C20
New College (Anglican) L6
Newton J12
Old Main Theatrette J14
Parade Theatre E3
Parking Station H25
Philip Baxter College D14
Robert Heffron (Chemistry) E12
Sam Cracknell Pavilion H8
Science Theatre F13
Shalom College (Jewish) N9
Sir John Clancy Auditorium C24
Sir Robert Webster
(Textile Technology) G14
Squash Courts B7
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 C20
Admissions Office B23
Anatomy C27
Applied Geology F10
Applied Science (Faculty Office) F10
Appointments Office B23
Architecture
(including Faculty Office) F10
Arts (Faculty Office) D20
Australian Graduate
School of Management F23
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biological Technology D26
Biomedical Library F23
Bookshop G17
Botany D26
Building H15
Cashier's Office B23
Centre for Medical Education
Research and Development F26
Chaplains E15
Chemical Engineering F10
Chemical Technology F10
Chemistry E12
Child Minding Centre N8
Civil Engineering H20
Closed Circuit Television Centre F19
Commerce (Faculty Office) F20
Community Medicine E25
Computing Services Unit F21
Drama D9
Economics F20
Education G1
Electrical Engineering G17
Engineering (Faculty Office) K17
English C19
Examinations and Student Records B22
Fees Office B23
Food Technology F10
French C20
General Studies C20
Geography (Extension) K17
German C20
Health Administration C22
History C20
History and Philosophy of Science C19
Industrial Arts B1
Industrial Engineering J17
Institute of Languages G14
Institute of Rural Technology B8
Law (Faculty Office) F21
Law Library F21
Librarianship B10
Library E21
Lost Property F20
Marketing F19
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 F18
Optometry H12
Pathology C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K13
Physical Education and
Recreation Centre (PERC) B5
Physiology and Pharmacology C27
Political Science C19
Postgraduate Committee
in Medical Education B27
Postgraduate Extension Studies
(Closed Circuit Television) F19
Postgraduate Extension Studies
(Radio Station and Administration) F23
Psychology F23
Public Affairs Unit C23
Regional Teacher Training Centre D26
Russian D20
Science (Faculty Office) F23
Social Work F1
Sociology C20
Spanish and Latin American Studies D19
Student Amenities and Recreation E15
Student Counselling and Research E16
Student Employment C22
Student Health E15
Students' Union E4
Surveying (Extension) K17
Teachers' College Liaison Office F16
Tertiary Education Research Centre E16
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
SQUASH
GYM
INTERNATIONAL HOUSE
NIDA
ARTS
CHANCELLERY
LIBRARY LAWN
MUSICAL
BOTANY STREET
GATE 10
PARADE THEATRE
THE UNIVERSITY UNION
FOUNDHOUSE
CHEMISTRY
COLLEGE RD
STUDENT HEALTH SERVICE
BASSER STEPS
LIBRARY
BIOLOGICAL SCIENCES
BIOMED THEATRES
STUDENT COUNSELLING
SCIENCE THEATRE
APPLIED SCIENCE BUILDING
TEXTILE TECHNOLOGY
ARCHITECTURE
LIBRARY ROAD
GATE 11
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
TENNIS COURTS
CIVIL ENGINEERING
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
PHYSICS ROAD
SCIENCE ROAD
ENGINEERING RD.
WILLIS STREET
METRES
40 30 20 10 0
50 30 10 0 50
TO KINGSFORD
AFFILIATED RESIDENTIAL COLLEGES
KINDERGARTEN
BARKER STREET
GATE 14
GATE 13

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, Professional Studies and Sciences are $2.50. Architecture, Law, Medicine and AGSM are $1.50. Postage is 40c in each case. The exception is General Studies, which is free.