The University of New South Wales

Engineering

1981 Faculty Handbook

How to use this Handbook

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

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

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

Faculty Information.

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

Graduate Study is about higher degrees.

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

Information includes:

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

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

Staff list.

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

The University of New South Wales

Engineering

1981 Faculty Handbook

The address of the University of New South Wales is:

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New South Wales, Australia 2033

Telephone: (02) 663 0351

Telegraph: UNITECH, SYDNEY

Telex AA26054

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

Information in this Handbook has been brought up to date as at 8 September 1980, but may be amended without notice by the University Council.

Contents

Undergraduate Study: Course Outlines

General Information

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

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

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

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

Some people who can help you

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

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

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

The Assistant Registrar (Student Records, Higher Degrees and Scholarships), Mr Peter Wildblood is located on the ground floor of the Chancellery. For particular enquiries regarding the Student Records Unit, including illness and other matters affecting performance in examinations, academic statements, graduation ceremonies, prizes, release of examination results and variations to enrolment programs, phone 3711.

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

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

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

The Student Health Unit is located in Hut E15b at the foot of Basser Steps. The Director is Dr Geoffrey Hansen. For medical aid phone 2679 or 3275.

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

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

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

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

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

Calendar of Dates

The Academic Year

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

Session 1 commences on the first Monday of March.

1981

Session 1 (14 weeks)	2 March to 10 May *May Recess:* 11 May to 17 May 18 May to 14 June *Midyear Recess:* 15 June to 19 July
Tuesday 16 June	Examinations begin
Wednesday 1 July	Examinations end
Session 2 (14 weeks)	20 July to 23 August *August Recess:* 24 August to 30 August 31 August to 1 November
Monday 9 November	Examinations begin
Friday 27 November	Examinations end

January

Thursday 1	New Year's Day – Public Holiday
Friday 2	Last day for applications for review of results of *annual* examinations
Friday 9	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University
Monday 26	Australia Day – Public Holiday

February

Thursday 5	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 16	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses

March

Monday 2	**Session 1 commences** Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out their degree for any other reason
Wednesday 11	List of graduands for April/May ceremonies and of 1980 prize-winners published in *The Sydney Morning Herald*
Friday 13	Last day for acceptance of enrolment by new undergraduate students (late fee payable thereafter)
Monday 16	Last day for notification of correction of details published in the press on 11 March concerning April/May graduation ceremonies
Friday 27	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable thereafter)

April

Friday 17 to Monday 20	Easter
Thursday 16	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Saturday 25	Anzac Day – Public Holiday
Monday 27	*Confirmation of Enrolment* forms despatched to all students

May

Wednesday 6	Last day for undergraduate students completing requirements for degrees or diplomas at the end of Session 1 to submit *Application for Admission to Degree* form Last day for acceptance of corrected *Confirmation of Enrolment* forms
Monday 11	**May Recess begins**
Thursday 14	Publication of provisional timetable for June/July examinations
Sunday 17	**May Recess ends**
Friday 22	Last day for students to advise of examination timetable clashes

June

Tuesday 2	Publication of timetable for June/July examinations
Monday 8	Queen's Birthday – Public Holiday
Sunday 14	**Session 1 ends** **Midyear Recess begins**
Tuesday 16	Examinations begin

July

Wednesday 1	Examinations end
Monday 13	Examination results mailed to students
Tuesday 14	Examination results displayed on University noticeboards
Tuesday 14 to Friday 17	Students to amend enrolment programs following receipt of June examination results
Sunday 19	**Midyear Recess ends**
Monday 20	**Session 2 begins** Last day for application for review of June examination results
Thursday 30	Foundation Day (no classes held)
Friday 31	Last day for students to discontinue without failure subjects which extend over the whole of academic year

August

Monday 24	**August Recess begins**
Sunday 30	**August Recess ends**

September

Tuesday 1	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out their degree for any other reason
Friday 4	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Wednesday 9	List of graduands for October graduation ceremonies published in *The Sydney Morning Herald*
Monday 14	*Confirmation of Enrolment* form forwarded to all students Last day for notification of correction of details published in the press on 9 September concerning October graduation ceremonies
Wednesday 23	Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit *Application for Admission to Degree* form Last day for acceptance of corrected *Confirmation of Enrolment* forms

October

Thursday 1	Last day to apply to UCAC for transfer to another tertiary institution in New South Wales Publication of provisional examination timetable

Monday 5	Eight Hour Day – Public Holiday
Friday 9	Last day for students to advise of examination timetable clashes
Thursday 22	Publication of timetable for examinations

November

Sunday 1	**Session 2 ends**
Monday 2	**Study Recess begins**
Sunday 8	**Study Recess ends**
Monday 9	Examinations begin
Friday 27	Examinations end

December

Monday 14	Examination results mailed to students
Tuesday 15	Examination results displayed on University noticeboards
Monday 21	List of graduands in Medicine for February graduation ceremony published in *The Sydney Morning Herald*
Friday 25	Christmas Day – Public Holiday
Saturday 26	Boxing Day – Public Holiday

1982

Faculties other than Medicine

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

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 26 January to 4 April Term 2 (9 weeks) 13 April to 9 May *May Recess:* 10 May to 16 May 17 May to 20 June Term 3 (9 weeks) 28 June to 29 August Term 4 (10 weeks) 6 September to 14 November
Fifth Year	Term 1 (8 weeks) 26 January to 21 March Term 2 (8 weeks) 29 March to 23 May Term 3 (8 weeks) 31 May to 25 July Term 4 (8 weeks) 2 August to 26 September Term 5 (8 weeks) 5 October to 28 November

January

Friday 1	Public Holiday
Monday 4	Last day for applications for review of results of *annual* examinations
Friday 8	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University

February

Monday 1	Australia Day – Public Holiday
Tuesday 2	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 15	Enrolment period begins for second and later year undergraduate students and students enrolled in formal graduate courses

March

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

April

Friday 9 to Monday 12	Easter – Public Holiday
Sunday 25	Anzac Day
Monday 26	Public Holiday

Organization of the University

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

In 1980 the University had 18,359 students and over 3,700 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W.S. and L.B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

Arms of the University of New South Wales

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

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

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

The Council

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

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

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

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

The Professorial Board

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

The Faculties/Boards of Study

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

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

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

The Schools

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

Executive Officers

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

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

General Administration

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

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

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

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

Student Representation on Council and Faculties/Boards

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

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

Open Faculty/Board Meetings

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

Award of the University Medal

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

Identification of Subjects by Numbers

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

Textbook Lists

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

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

Co-operative Bookshop

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

General Studies Program

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

Student Services and Activities

Accommodation

Residential Colleges

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

The Kensington Colleges

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

International House

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

New College

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

Shalom College

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

Warrane College

Warrane 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 range of activities and opportunities to meet members of the University staff informally. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. Warrane is directed by the Catholic lay association Opus Dei. Apply in writing to the Master, Dr J. F. Martins, Warrane College, PO Box 123, Kensington, NSW 2033.

Creston Residence

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

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may contact the Housing Officer in the Student Amenities and Recreation Section for assistance in obtaining suitable accommodation 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. Accommodation in the immediate vicinity of the University is not usually easy to find at short notice, and is expensive.

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

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

Associations, Clubs and Societies

The Sports Association

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

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

2673. The control of the Association is vested in the General Committee comprising delegates from the thirty-eight clubs.

Membership is compulsory for all registered students, and the annual fee is $11. Membership is also open to all members of staff and graduates of the University on payment of an annual fee as prescribed in the By-Laws of the Association. All members are invited to take part in any of the activities arranged by the Association, and to make use of the University's sporting and recreational facilities.

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

School and Faculty Associations

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

Australian Armed Services

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

Chaplaincy Centre

The University Chapel

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

Chaplaincy Service

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

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

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

Deputy Registrar (Student Services)

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

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

All enquiries should be made either at room 148E or by telephoning extension 2482 (general enquiries) or 3164 (financial assistance).

Student Amenities and Recreation Section

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

The Section is responsible for the continuing management of the Physical and Recreational Centre at which recreational programs are available for both students and staff; makes bookings for use of sports facilities; and in consultation with the Sports Association assists various recognized clubs.

Mr I. Moutray is the Head of the Section, which is located in the huts at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Recreation Program 3271; Grounds Bookings 2235; Sports Association 2673.

Physical Education and Recreation Centre

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

Student Counselling and Research Unit

The Student Counselling and Research Unit has both service and research and development functions. The service function is to help clients – students, prospective students, parents and other concerned persons – improve their approach to planning, decision-making and coping with academic, vocational and personal aspects of their life. The research and development function is to develop and evaluate counselling practices and programs and to assist in improving the quality of student life.

Appointments for counselling consultations are available from 9 am to 7 pm, and may be made by 'phoning 663 0351 extension 3681 and 3685 or by calling at the Unit, which is located at the foot of Basser Steps. In urgent cases interviews can be given on a walk-in basis between 9 am and 5 pm.

Student Employment Section

The Student Employment Section provides assistance with careers and employment.

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

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

The Section is located in the Chancellery.

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

Student Health Unit

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

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

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

Appointments may be made by calling at the centre or by telephoning extension 2679, 3275 or 3841 during the above hours.

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

The Students' Union

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

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

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

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

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

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

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

1. Infakt – a student-run information referral service for students who want someone to talk to or need help of any kind. Infakt is located in the bus at the foot of Basser Steps.

2. A casual employment service.

3. Organization of orientation for new students.

4. Organization of Foundation Day.

5. The University's two child care centres.

6. Publication of the student paper *Tharunka*.

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

8. SU Record Shop which offers discount records and tapes.

9. The Nuthouse which deals in bulk and health foods.

10. Secondhand Bookshop for cheap texts.

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

12. The sale of electronic calculators and accessories at discount rates.

13. Provision of a bail fund.

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

The University Library

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

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

There are also library services at other centres:.

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

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

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

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

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

The University Union

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

The Union is housed in three buildings near the entrance to the Kensington Campus from Anzac Parade. These are the Roundhouse, the Blockhouse and the Squarehouse. Membership of the Union is compulsory at $55 per year for all registered students and is open to all members of staff and graduates of the University.

The control of the Union is vested in the Board of Management whose Chief Executive Officer is the Warden; the President is Mr R. P. Hammond.

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. 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.

Financial Assistance to Students

Tertiary Education Assistance Scheme

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

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

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

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

Tertiary students receiving an allowance, and prospective tertiary students, will be sent application forms in January 1981. Forms will also be available from the Admissions Section *or* the Student Employment Section, *or* from the Director, Department of Education, 59 Goulburn Street, Sydney, NSW 2000 (telephone 218 8800). Continuing students should submit applications as soon as examination results are available. New students should do so as soon as they are enrolled. All students should apply by 31 March 1981, otherwise benefits will not be paid for the earlier months of the year.

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

Other Financial Assistance

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

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

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

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

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

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

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

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

Financial Assistance to Aboriginal Students

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

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 staff who wishes to remain anonymous) available for projects of benefit to handicapped and disabled students. Enquiries should be made at the office of the Deputy Registrar (Student Services), Room 148E, in the Chancellery.

Rules and Procedures

The University, in common with other large organizations, has established rules and procedures which are designed for the benefit of all members of the University. In some cases there are penalties (eg fines or exclusion from examinations) for non-compliance. Therefore, any student who after reading the rules carefully requires further information on their application should contact the Admissions Office or the Registrar.

General Conduct

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

Appeals

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

Admission and Enrolment

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

The office provides information about special admission, admission with advanced standing and admission on overseas qualifications. The office also receives applications from students who wish to transfer from one course to another, resume their studies after an absence of twelve months or more, or seek any concession in relation to a course in which they are enrolled. It is essential that the closing dates for lodgement of applications are adhered to. For further details see the section on Undergraduate and Graduate Enrolment Procedures and Fees.

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on Requirements for Admission) are referred by the Admissions 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 Higher Degrees Unit, after obtaining a recommendation from the Head of School, refers the application to the appropriate Faculty or Board of Studies Higher Degree Committee.

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

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

First Year Entry

Those seeking entry to first year courses in one or more of the three universities in the Sydney Metropolitan area (Macquarie University, the University of New South Wales and the University of Sydney) are required to lodge a single application form with the Universities and Colleges Admissions Centre, Challis House, 10 Martin Place, Sydney 2000 (GPO Box 7049, Sydney 2001). On the application form provision is made for applicants to indicate preferences for courses available in any one of the three universities and eighteen other tertiary institutions. Students are notified individually of the result of their applications and provided with information regarding the procedures to be followed in order to accept the offer of a place at this University. Enrolment is completed at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

Deferment of First Year Enrolment

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

Enrolment Procedures and Fees Schedules 1981

1. Introduction

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

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

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

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

2. New Undergraduate Enrolments

Persons who are applying for entry in 1981 must lodge an application for selection with the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1980.

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

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

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

3. Re-enrolment

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

Students who are continuing courses (or returning after approved leave of absence) should enrol through the appropriate School in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Admissions Office and from School offices. Those who have completed part of a course and have been absent without leave need to apply for entry through the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1980.

4. Restrictions Upon Re-enrolling

Students who in 1980 have infringed the rules governing re-enrolment should not attempt to re-enrol in 1981 but should follow the written instructions they will receive from the Registrar.

5. New Research Students

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

6. Re-enrolling Research Students

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

7. Submission of Graduate Thesis or Project Report

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

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

8. Enrolments by Miscellaneous Students

Enrolments by miscellaneous students are governed by the following rules:

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

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

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

(4) A student who is subsequently admitted to a course of the University for which any subjects completed as a miscellaneous student form a part may receive standing for those subjects in accordance with the rules relating to Admission with Advanced Standing, save that a student may not receive standing for any subject completed as a miscellaneous student while under exclusion from a course of the University.

9. Final Dates for Completion of Enrolment

No enrolments for courses extending over the whole year or for Session 1 only will be accepted from new students after the end of the second week of Session 1 (13 March 1981) 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 (27 March 1981) 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 (27 March 1981) 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 (31 July 1981) except with the express approval of the Deputy Registrar (Student Services) and the Heads of Schools concerned.

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

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

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

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

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

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

New students are issued with cards on enrolment if eligible.

11. Payment of Fees

There are no fees for tuition but other fees and charges are payable. These include those charges raised to finance the expenses incurred in operating activities such as the University Union, the Students' Union, the Sports Association, and the Physical Education and Recreation Centre. Penalty payments are also incurred if a student fails to complete procedures as required. Charges may also be payable, sometimes in the form of a deposit, for the hiring of kits of equipment in certain subjects. Accommodation charges, costs of subsistence on excursions, field work, etc, and for hospital residence (medical students) are payable in appropriate circumstances.

12. Assisted Students

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

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

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

13. Extension of Time

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

14. Failure to Pay Fees and Other Debts

Any student who fails to pay prescribed fees or charges or is otherwise indebted to the University and who fails either to make a satisfactory settlement of his indebtedness upon receipt of due notice or to receive a special exemption ceases to be entitled to the use of University facilities. Such a student is not permitted to register for a further session, to attend classes or examinations, or to be granted any official credentials. In the case of a student enrolled for Session 1 only or for both Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (24 April 1981). 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 (28 August 1981).

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

15. Student Fees

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

All students (with the exceptions set out in section **17.** 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 the full University Union Entrance Fee, if applicable, and one half of any other fees due.

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

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

University Union Entrance Fee

Payable on first enrolment	$25

Student Activities Fees

University Union annual subscription	$55
Sports Association annual subscription	$11
Students' Union Annual Subscription	
Students enrolling in full-time courses	$17
Students enrolling in part-time courses or as miscellaneous students	$13
Miscellaneous Fund annual fee	$25

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

Special Examination Fees

Examinations conducted in special circumstances for each subject	$11
Review of examination results for each subject	$11

Other Fees

Depending on the subject being taken, students may also be required to pay:

Pathology Instrument Kit	$10

(Refundable on return in satisfactory condition)

16. Penalties

(1) Failure to lodge enrolment form according to enrolment procedure	$20
(2) Payment of fees after end of second week of session	$20
(3) Payment of fees after end of fourth week of session	$40

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

17. Exemptions – Fees

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

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

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

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

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

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

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

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

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

(9) All Student Activities Fees, for one or more sessions, may be waived by the Deputy Registrar (Student

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

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

Services) for students who are given formal permission to pursue their studies at another institution for one or more sessions.

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

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

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

18. Variations in Enrolment (including Withdrawal)

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

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

(3) Enrolment in additional subjects

Applications for enrolment in additional subjects must be submitted by:

27 March 1981 for Session 1 only and whole year subjects;

14 August 1981 for Session 2 only subjects.

(4) Withdrawal from subjects

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

(a) for one session subjects, the end of the seventh week of that session (17 April or 4 September)

(b) for whole year subjects, the end of the second week of Session 2 (31 July).

(5) Withdrawal from Course – Refunds

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

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

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

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

(ii) if the notice of withdrawal is given before the end of the fourth week of Session 1 (27 March 1981) a full refund of other Student Activities Fees paid will be made; if notice is given before the end of the eighth week of Session 1 (24 April 1981) a refund of one half of the other Student Activities Fees paid will be made; thereafter no refund will be made except that provided for in (iii) below.

(iii) if a student's enrolment in any year is for Session 2 only and the student gives notice of withdrawal prior to the end of the fourth week of Session 2 (14 August 1981) a full refund of Student Activities Fees paid (other than the University Union Entrance Fee for which see item (i) above) will be made; if notice is given before the end of the eighth week of Session 2 (11 September 1981) a refund of one half of the other Student Activities Fees paid will be made; thereafter no refund will be made.

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

(6) Acknowledgements

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

(a) variations lodged before the Friday of the seventh week of each session (17 April or 4 September) will be incorporated in the *Confirmation of Enrolment Program* notice forwarded to students on 27 April or 14 September as appropriate

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

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

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

19. Exemption – Membership

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

Private Overseas Students

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

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

All private overseas students must advise the Department if they change their term residential address during the year. Telephone enquiries should be directed to (02) 218 8923, and country students may reverse the charge for the call.

Leave of Absence

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

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

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

Course Transfers

Students wishing to transfer from one course to another must complete and submit an application form, obtainable from the Admissions Office, the Chancellery, by Friday 9 January 1981.

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

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

Students should also advise the enrolling officer in the school in which they were enrolled in 1980 of their intention to transfer.

Admission with Advanced Standing

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

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

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

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

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

5. the standing granted by the Board in the case of any application based on the partial completion of the

requirements for any degree or other award of the University may be such as to give full credit in the course to which the applicant seeks to transfer for work done in the course from which the student transfers.

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

Resumption of Courses

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

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

Examinations

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

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

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

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

Assessment of Course Progress

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

Examination Results

Grading of Passes

Passes will be graded as follows:

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

Pass Conceded

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

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

Availability of Results

Final examination results will be posted to a student's term address, or vacation address if requested. Change of address forms and forms requesting that results be posted to a vacation address are included in the examination timetable and are obtainable at the Student Enquiry Counter, the Chancellery. Both forms can be accepted up to Friday 27 November. Results are also posted on School noticeboards and in the University Library. Results on noticeboards are listed *by Student Registration Number.*

No examination results are given by telephone.

Review of Results

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

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

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

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

Special Consideration

Students who believe that their performance in a subject, either during session or in an examination, has been

adversely affected by sickness or any other reason should inform the Registrar and ask for special consideration in the determination of their standing.

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

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

Physical Disabilities

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

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

Use of Electronic Calculators

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

Examinations Held Away from the Campus

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

Arrival at Examinations

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

Use of Linguistic Dictionaries

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

Conduct of Examinations

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

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

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

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

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

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

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

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

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

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

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

Acknowledgement of Sources

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

Further Assessment

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

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

Restrictions upon Students Re-enrolling

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

First Year Rule

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

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

Repeated Failure Rule

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

General Rule

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

The Session-Unit System

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

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

Exemption from Rules by Faculties

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

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

Showing Cause

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

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

Appeal

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

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

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

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

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

The decision of the Committee shall be final.

(3) The notification to students of a decision which has been upheld by the Re-enrolment Committee of the Professorial Board to exclude them from re-enrolling in a

* See reference to Schedule A on next page.

course and/or subject shall indicate that they may appeal against that decision to the Appeal Committee. The appeal must be lodged with the Registrar within fourteen days of the date of notification of exclusion; in special circumstances a late appeal may be accepted at the discretion of the Chairman of the Appeal Committee. In lodging such an appeal with the Registrar students should provide a complete statement of all grounds on which the appeal is based.

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

Exclusion

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

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

Re-admission after Exclusion

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

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

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

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

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

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

Restrictions and Definitions

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

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

Schedule A

The prescribed 'minimum number of subjects units or credits' for the purposes of determining liability under the 'First Year Rule' is under consideration by faculties and boards of studies at the time of printing. An up-to-date list may be obtained from the Registrar.

Admission to Degree or Diploma

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

Students who have indicated on their enrolment form that they are potential graduands are forwarded an application form with their Enrolment Details form in September (or, in the case of students who expect to satisfy requirements at the end of Session 1, with the form issued in

April). Students who do not complete an application form will not graduate; students who do not return their application form by the due date will graduate at a later series of ceremonies.

The Registrar will acknowledge receipt of the application form within two weeks. If no acknowledgement is received within that period students should contact the Student Records Section immediately.

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

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

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

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

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

Attendance at Classes

Students are expected to be regular and punctual in attendance at all classes in the course or subject in which they 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 students may be excused by the Registrar for non-attendance at classes for a period of not more than one month or, on the recommendation of the Dean of the appropriate Faculty, for a longer period.

Absence from Classes

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

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

Student Records

Confirmation of Enrolment Program notices are sent to all students on 27 April and 14 September. It is not necessary to return these forms unless any of the information recorded is incorrect. Amended forms must be returned to the Student Records 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 fourteen days.

Release of Information to Third Parties

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.

Change of Address

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

All communications from the University, including examination results, will be sent to the Session or Term address except when arrangements are made otherwise in the case of examination results (see **Examinations: Availability of Results**, earlier in this section). *Change of Address Advice* forms will be accepted up to Friday 27 November, except for final-year students wishing to change their *Application for Admission for Degree/ Diploma* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

Ownership of Students' Work

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

Notices

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

Parking within the University Grounds

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

Academic Dress

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

Further Information

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.

The Calendar

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

Vice-Chancellor's Official Welcome to New Students

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

Full-time Students

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

Thursday 26 February 1981
11 am in the Clancy Auditorium

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

Friday 27 February 1981
11 am in the Clancy Auditorium

Part-time Students

Thursday 26 February 1981
6.30 pm in the Clancy Auditorium

Meeting for Parents of New Students

Friday 27 February 1981
7.30 pm in the Clancy Auditorium

Foreword

The Faculty of Engineering Handbook

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

The Faculty of Engineering

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

School of Civil Engineering

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

The Department of Water Engineering encompasses the fields of Hydraulics, Hydrology, Water Resources and Public Health Engineering. The Public Health Engineering Laboratory is located at Kensington. The Hydrology research centre is also at Kensington, but a substantial amount of investigation is carried out in the field. The Water Research Laboratory is located at Manly Vale and is the centre for instruction and research in hydraulics.

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

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

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

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

School of Electrical Engineering and Computer Science

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

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

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

School of Mechanical and Industrial Engineering

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

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

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

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

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

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

School of Nuclear Engineering

The School of Nuclear Engineering in the University of New South Wales was established in 1961. The School presently operates at the graduate level in the Faculty of Engineering. A fourth year undergraduate subject in Nuclear Power Technology is provided as an elective for other Schools (23.051 Nuclear Power Technology).

In addition to the supervision of programs of advanced study and research for candidates undertaking a research degree leading to the award of Master of Engineering, Master of Science or Doctor of Philosophy, the School offers a formal graduate course leading to the award of the degree of Master of Engineering Science. This formal course aims specifically at the education of engineers for the detailed understanding, analysis and assessment of nuclear reactors and nuclear power systems. Particular attention is given to the mathematical, numerical and computational techniques which are relevant to nuclear engineering.

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

The School is presently situated in the Electrical Engineering building at Kensington. Library, workshop, digital and analogue computing facilities are available. Special digital and analogue equipment for the analysis and recording of random signals has been acquired for experimental noise research. Through the Australian Institute of Nuclear Science and Engineering, the special facilities of the Australian Atomic Energy Commission's Research Establishment at Lucas Heights can be made available for research purposes. Close personal contact is maintained between members of the School and the Engineering Research Division at Lucas Heights.

School of Surveying

The School of Surveying consists of three Departments: Geodesy; Photogrammetry, including land studies and cartography; and Surveying, including astronomy and computations. It offers a full-time course of four years duration leading to the degree of Bachelor of Surveying. Alternatively, the course may be taken in a Sandwich form in which a student may, after completing the first year of the course on a full-time basis, alternate his or her studies with periods of employment by taking leaves of absence of up to two consecutive sessions at a time thereafter. The course taken in this form requires a maximum period of seven years. The part-time course is no longer available.

Commencing in 1981, the School also offers a full-time course of four years' duration leading to the degree of Bachelor of Surveying Science. The new course is designed to give an interested student the opportunity to obtain greater depth as an undergraduate in one or more of the several disciplines associated with surveying: land development, cartographic science, geodesy and geophysics, environmental studies, remote sensing and photogrammetry.

The graduate courses offered are Master of Surveying Science, a two-year part-time or one-year full-time course; and the research degrees Master of Surveying and Doctor of Philosophy.

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

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

Centre for Biomedical Engineering

The Centre was established in 1976 as an interdisciplinary unit to promote and coordinate biomedical engineering studies and research being conducted by various departments within the University and its associated teaching hospitals. Biomedical engineering involves the application of engineering techniques to biomedical problems with particular emphasis on clinical medicine.

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

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

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/Chairman

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

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

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

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

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

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

N. L. Svensson
Dean/Chairman
Faculty of Engineering

Faculty Information

Who to Contact

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

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

School of Electrical Engineering and Computer Science: Associate Professor C. A. Stapleton, Room G6, *or* Ms R. C. Horwood, School Office, School of Electrical Engineering and Computer Science

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

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

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

Centre for Biomedical Engineering: Associate Professor P. C. Farrell, Room 508, Geography & Surveying Building

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

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1981 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1981* available from School Offices and the Admissions Office. This booklet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Faculty of Engineering Library Facilities

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

The Physical Sciences Library

This library serves the information needs of senior undergraduate students, graduate students and members of the

academic staff. It contains books, a large collection of journals, and guides to the literature including abstracting and indexing journals in the subject areas of pure and applied science, technology, engineering and architecture. The library also houses a growing map collection and some microform material. All material in the library bears the prefix 'P' and is indexed in the library's central catalogue on Level 2. There is also a catalogue in the Physical Sciences Library. There is seating for approximately 300 people, and a number of room carrels and seminar rooms are available for use. Photocopying facilities are provided. Journals may not be borrowed from the collection. The library staff on Level 7 are ready to assist readers with any enquiries.

Physical Sciences Librarian Marian Bate

The Undergraduate Library

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

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

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

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

Undergraduate Librarian Pat Howard

Student Clubs and Societies

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

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

The following scoieties serve the interests of students in the various courses in the Faculty of Engineering: Biomedical Engineering Society (BioEng Soc); Electrical Engineering Society (ELSOC); Civil Engineering Student Society (CIVSOC); Naval Architecture Student Association (NASA); Surveying Society (SURVSOC); Computing Science Association (CSA); Undergraduate Society of Mechanical & Industrial Engineers (USMIE).

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

Location of Laboratories outside Kensington Campus

Randwick

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

Manly Vale

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

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

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

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

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

The Institution of Engineers, Australia

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

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

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

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

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

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

The Institution of Surveyors, Australia

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

The Rupert H. Myers Award in Materials Engineering

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

Undergraduate Study

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

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

First Year Programs

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

General Rules for Progression

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

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

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

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

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

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

Prerequisites and Co-requisites

- A prerequisite unit is one which must be completed prior to enrolment in the unit for which it is prescribed.

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

Full-time Courses

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

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

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

Industrial Training Requirements

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

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

Part-time Courses

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

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

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

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

A student completing the BSc(Eng) degree course and wishing to qualify for the corresponding BE degree may, on the recommendation of the Head of the School, transfer to the corresponding full-time BE course provided he does not take out the BSc(Eng) degree. Further, provided he continues as a registered student on transfer from one course to the other, he may retain any concession granted in the BSc(Eng) degree course.

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

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

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

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

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

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

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the appropriate school and pass the necessary examinations;

(3) complete an approved program of industrial training over such period as is prescribed concurrently with attendance in the course. In general, this training must be completed before 31 January in the year in which the degree is to be 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.

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

Conditions for the Award of the Degree of Bachelor of Engineering

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

(1) comply with the requirements for admission;

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

(3) complete an approved program of industrial training for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

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

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

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

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

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

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

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

(1) comply with the requirements for admission;

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

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

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

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

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

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

Undergraduate Study

Course Outlines

School of Civil Engineering

Head of School
Professor R. W. Woodhead

Senior Administrative Officer
Mr R. W. Prior

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

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

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

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

3620
Civil Engineering Full-time Course

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.981	Physics ICE*	5	3
2.981	Chemistry ICE**	6	2
5.0102	Introduction to Engineering Design	2	0
5.0201	Engineering Dynamics	0	3
5.0301	Engineering Drawing	0	3
8.170	Statics	3	0
8.171	Mechanics of Solids	0	3
8.271	Introduction to Materials	0	2
8.360	Computing	0	3
8.670	Introduction to Engineering Construction	1	0
10.001	Mathematics I***	6	6
		23	25

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

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

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

Year 2

		Hours per week S1	S2
8.172	Mechanics of Solids II	4	0
8.1811	Structural Design IA	3	0
8.1812	Structural Design IB	0	3
8.2721	Civil Engineering Materials I	4	0
8.2722	Civil Engineering Materials II	0	4
8.301	Systems Engineering	2	2
8.571	Hydraulics I	0	3
8.671	Engineering Construction	3	0
10.022	Engineering Mathematics II	4	4
29.441	Surveying for Engineers	0	6
29.491	Survey Camp†	1½	1½
	Two Electives***	3	3
		24½	26½

In 1982 8.301 is deleted, the following are introduced

8.311	Systems Engineering I	2	0
8.312	Systems Engineering II	0	2
8.361	Probability and Statistics	2	0

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

Year 3

8.173	Structural Analysis I	3	0
8.174	Structural Analysis II	0	3
8.1821	Structural Design IIA	3	0
8.1822	Structural Design IIB	0	3
8.2731	Geotechnical Engineering I	2	0
8.2732	Geotechnical Engineering II	0	2
8.2733	Rock engineering	0	2
8.351	Engineering Mathematics	5	0
8.400	Transport Engineering I	3	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
	One Elective***	0	3
		22	23

In 1983 8.351 is deleted, the following is introduced

8.362	Engineering Computations	3	0

***See Electives on following page.

Year 4

8.001	Industrial Training	0	0
8.191	Structural Engineering	3	0
8.2741	Concrete Technology	0	4
8.2742	Metals Engineering	2	0
8.583	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
		20	21

***See Electives on following page.

In 1982 the following is introduced

8.401	Transport Engineering II	3	0

3620
Civil Engineering Part-time Course

Bachelor of Engineering
BE

Stage 1

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

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

Stage 2

2.981	Chemistry ICE**	6	2
5.0102	Introduction to Engineering Design	0	2
5.0201	Engineering Dynamics	0	3
5.0301	Engineering Drawing	0	3
8.170	Statics	3	0
8.171	Mechanics of Solids	0	3
8.271	Introduction to Materials	2	0
8.360	Computing	3	0
8.670	Introduction to Engineering Construction	0	1
		14	14

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

Stage 3

8.172	Mechanics of Solids II	0	4
8.2721	Civil Engineering Materials I	0	4
8.2722	Civil Engineering Materials II	4	0
10.022	Engineering Mathematics II	4	4
29.441	Surveying for Engineers*	6	0
29.491	Survey Camp†	1½	1½
		15½	13½

*Includes 28 hours of Saturday fieldwork as an essential part of the subject.
†Students are required to attend a one-week Survey Camp, equivalent to 1½ class contact hours per week in each session.

Stage 4

8.1811	Structural Design IA	0	3
8.2731	Geotechnical Engineering I	0	2
8.2733	Rock Engineering	2	0
8.301	Systems Engineering	2	2

		Hpw S1	S2
8.571	Hydraulics I	3	0
8.671	Engineering Construction	0	3
	Three Electives***†	6	3
		13	13

In 1983 8.301 is deleted, the following are introduced

8.311	Systems Engineering I	0	2
8.361	Probability and Statistics	0	2

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

Stage 5

8.173	Structural Analysis I	0	3
8.1812	Structural Design IB	3	0
8.1821	Structural Design IIA	0	3
8.2732	Geotechnical Engineering II	2	0
8.351	Engineering Mathematics	0	5
8.400	Transport Engineering I	3	0
8.572	Hydraulics II	0	3
8.672	Planning & Management I	4	0
	One Elective***	3	0
		15	14

In 1984 8.400 is taken in Session 2, 8.351 is deleted and the following are introduced:

8.312	Systems Engineering II	2	0
8.362	Engineering Computations	0	3

***See Electives opposite.

Stage 6

8.174	Structural Analysis II	3	0
8.1822	Structural Design IIB	3	0
8.191	Structural Engineering	0	3
8.2741	Concrete Technology	4	0
8.2742	Metals Engineering	0	2
8.573	Hydraulics III	3	0
8.581	Water Resources I	0	3
	Two Electives***	0	6
		13	14

***See Electives opposite.

Stage 7

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

In 1983 the following is introduced:

8.401	Transport Engineering II	0	3

***See Electives opposite.

Electives

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

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

Approved technical electives for Year 3 include those listed for Year 2 and 8.015 Road Engineering, 8.018 Construction Engineering, 8.021 Environmental Aspects of Civil Engineering, 8.023 Hydrodynamics, 8.027 New Materials I, 8.029 Continuum Mechanics, 8.041 Geological Engineering, 8.081 Probability and Statistics for Civil Engineers, 15.501 Introduction to Industrial Relations.

Approved technical electives for Year 4 include those listed for Year 2 and Year 3 and 8.011 Projects, 8.012 Elements of Architecture, 8.013 Bridge Engineering, 8.014 Computer Applications in Civil Engineering, 8.016 Hydraulics, 8.017 Transportation Engineering, 8.019 Railway Engineering, 8.020 Hydrology, 8.024 Foundation and Dam Engineering, 8.025 Structural Failures, 8.026 Systems Methods in Civil Engineering, 8.028 New Materials II, 8.030 Construction Management, 8.031 Construction Project Finance, 8.032 Construction Law, 8.034 Engineering Economy, 8.038 Special Topics in Reinforced Concrete, 8.042 Water Resources, 8.043 Public Health Engineering, 8.055 Applied Structural Analysis, 8.056 Practical Structural Design, 8.057 Special Topics in Prestressed Concrete, 8.058 Special Topics in Steel Design, 8.059 Structural Vibrations, 8.060 Numerical Methods in Geotechnology, 8.062 Construction Camp, 8.082 Numerical Methods for Civil Engineers.

Double Degree

3730
Double Degree of BSc BE in Civil Engineering

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

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

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

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

There are six approved programs but additional ones may be approved if they are relevant.

Physical Metallurgy and Chemistry

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

Year 2
2.002A, 2.042C
4.402, 4.502
8.172, 8.1811, 8,1812, 8.2721, 8.2722
10.022
1 elective†

Year 3
4.403, 4.703
8.173, 8.174, 8.1821, 8.1822, 8.351, 8.400, 8.571
29.441, 29.491
1 elective†
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.

Year 4
2.003A, 2.003C, 2.013C
4.503
8.273, 8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
In 1984 8.301 is deleted.

Year 5
2 electives†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
In 1983 8.401 is introduced.

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

Geography and Environmental Chemistry

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

Year 2
2.002A, 2.002D, 2.042C
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.022
27.801, 27.802

Year 3
2.043A
8.173, 8.174, 8.1821, 8.1822, 8.400, 8.351, 8.571
27.811, 27.813
29.441, 29.491
1 elective†
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.

Year 4
8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
27.103
2 electives†
Choose 2 from:
27.203, 27.413, 27.423, 27.862, 27.863
In 1984 8.301 is deleted.

Year 5
2 electives†
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
In 1983 8.401 is introduced.

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

Physics with Mathematics

Year 1
1.001 *or* 1.011
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

Year 2
1.012
1.022, 1.032
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.1113 or 10.1213,
10.1114 or 10.1214,
10.2111 or 10.2211,
10.2112 or 10.2212
2 electives†

Year 3
1.023, 1.043, 1.053, 1.3233
8.173, 8.174, 8.1821, 8.1822, 8.351, 8.400, 8.571
10.111A or 10.121A
29.441, 29.491
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.

Year 4
1.033
1.1333
8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 2 Level II or Level III Mathematics units from Table 1 in the Sciences Handbook.
In 1984 8.301 is deleted.

Year 5
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.
In 1983 8.401 is introduced.

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

Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

Year 2
8.172, 8.1811, 8.1812, 8.2721, 8.2722
10.111A or 10.121A,
10.1113 or 10.1213,
10.1114 or 10.1214,
10.2111 or 10.2211,
10.2112 or 10.2212
1 elective†
Choose either **1.** *or* **2.***:*
1. *10.311A or 10.321A,*
10.311B or 10.321B

2. *Choose 3 units from:*
10.411B or 10.421B,
10.411A or 10.421A,
10.331,
10.2113 (or 10.2213) and 10.2114 (or 10.2214),
10.1111,
10.1112 or 10.121C

Year 3
8.173, 8.174, 8.1821, 8.1822, 8.351, 8.400, 8.571
29.441, 29.491
1 elective†
Choose 4 units from Mathematics from Table 1 of the Sciences Handbook (at least one must be Level III).
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.

Year 4
8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 3 Level III (not Level II/III) Mathematics units from Table 1 of the Sciences Handbook.
In 1984 8.301 is deleted.

Year 5
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
Choose 1 or 2 units from Tables 1 or 3 in the Sciences Handbook at Level II or higher.
In 1983 8.401 is introduced.

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

Geology with some Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

Years 2, 3, 4, 5 and footnotes appear overleaf.

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

Year 3
2.042C
8.173, 8.174, 8.1821, 8.1822, 8.351, 8.400, 8.571
25.211, 25.221, 25.212
29.441, 29.491
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.

Year 4
8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
Choose four subjects from the following:
25.311, 25.312, 25.314, 25.321, 25.313, 25.324, 25.325, 25.326‡
In 1984 8.301 is deleted.

Year 5
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.
In 1983 8.401 is introduced.

Note: All material not in italic typeface refers to the BE degree component of this combined degree course.
‡Students enrolling in Level III subjects in 1980 should refer to the 1979 Sciences Handbook for subject descriptions.
* ** *** † See footnotes below.

Computing with some Mathematics

Year 1
1.981*
2.981**
5.0102, 5.0201, 5.0301
8.170, 8.171, 8.271, 8.360, 8.670
10.001***

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

Year 3
6.642, 6.643
8.173, 8.174, 8.1821, 8.1822, 8.351, 8.400, 8.571
10.2111 or 10.2211,
10.2112 or 10.2212
29.441, 29.491
In 1983 8.351 is deleted; 8.311, 8.312, 8.361 and 8.362 are introduced.
Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 4
6.646, 6.647, 6.649
8.2731, 8.2732, 8.2733, 8.301, 8.572, 8.573, 8.581, 8.582, 8.671, 8.672
1 elective†
Choose 1 Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.
In 1984 8.301 is deleted.

Year 5
8.001, 8.191, 8.2741, 8.2742, 8.583, 8.673, 8.674, 8.051, 8.052, 8.053, 8.054
2 electives†
Choose 1 or 2 units from Table 1 in the Sciences Handbook at Level II or higher.
In 1983 8.401 is introduced.

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

*Students are advised to attempt 1.981 Physics 1CE but if time-tabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt 1.001 Physics I or 1.011 Higher Physics I. On successful completion of one of these latter subjects students will be exempted from one technical elective.

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

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

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

School of Electrical Engineering and Computer Science

Head of School
Professor N. W. Rees

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

Senior Administrative Officer
Mr H. G. Phillips

Adminstrative Assistant
Ms Robyn Horwood

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

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

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

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

The degrees of Bachelor of Engineering and Bachelor of Science (Engineering) are recognized by the Institution of Engineers, Australia and the Institution of Radio and Electronics Engineers, Australia, as giving complete exemption from the examinations required for admission to Graduate or Corporate membership.

Honours

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

Industrial Experience

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

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

3640
Electrical Engineering

Bachelor of Engineering
BE

Year 1†

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

†Students who plan to specialize in Computer Science either in a BSc/BE course or within the BE degree program, should consult the School before enrolling in Year 1.

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

Year 2

1.972	Electromagnetism	0	4
1.982	Solid State Physics	4½	0
10.111A	Pure Mathematics II (Linear Algebra)*	2	2
10.1113	Pure Mathematics II — Multivariable Calculus*	2½	0
10.1114	Pure Mathematics II — Complex Analysis*	0	2½

		Hpw S1	S2
10.2111	Applied Mathematics II — Vector Calculus*	2½	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations*	0	2½
	One General Studies Elective	3	0
Electrical Engineering II			
6.021A	Circuit Theory I	4	0
6.021B	Power	0	4
6.021C	Electronics I	0	4
6.021D	Computing	4	0
6.021E	Digital Logic and Systems	0	4
		22½	23

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

Year 3*

10.033	E. E. Mathematics III	2	2
10.361	Statistics SE	2	2
	One General Studies Elective	3	0
	One Technical Elective†	0	4
Electrical Engineering III			
6.0311	Circuit Theory II	4	0
6.0312	Utilization of Electric Energy	4	0
6.0313	Electronics II	4	0
6.0314	Systems and Control I	0	4
6.0315	Electrical Energy	0	4
6.0316	Electronics III	0	4
6.0317	Communications Systems I	0	4
6.0318	Microprocessor Systems and Applications	4	0
		23	24

†Technical Electives available in 1981

1.012	Mechanics and Thermal Physics	5	0
8.113	Civil Engineering	0	4
6.056	Mechanical Engineering	0	4
6.641	Programming I	0	5
48.302	Fuels and Energy	0	4

A free choice may not be possible.

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

Year 4 (1981 only)

	General Studies Elective	3	0
Electrical Engineering IV			
	6 Professional Electives†	20	10
6.911	Thesis*	2	21
6.903	Industrial Training‡		
		25	31

Year 4 (1982 onwards)

		Hpw	
	General Studies Elective	3	0
	One Technical Elective	4	0
Electrical Engineering IV			
	5 Professional Electives†	15	10
6.911	Thesis*	2	21
6.903	Industrial Training‡		
		24	31

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

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

†Electrical Engineering IV Professional Electives

In 1981 four Electives are taken in Session 1 and two in Session 2. From 1982 onwards three electives are taken in Session 1 and two in Session 2. The program selected by each student must be approved by the Head of School. Not all electives are offered every session: students are advised each year which electives are available. Each elective is 5 hours per week for one session.

The list of electives is*:

6.041 Electrical Measurements
6.042 Digital and Analogue Signals
6.044 Electrical Product Design and Reliability
6.045 Electrical and Electronics Engineering Materials
6.202 Power Engineering I
6.203 Power Engineering II
6.212 Power Engineering—Utilization
6.222 High Voltage and High Current Technology
6.303 High Frequency Circuits and Electronics I
6.313 High Frequency Circuits and Electronics II
6.322 Electronics IV
6.323 Communication Systems 2A
6.333 Communication Systems 2B
6.412 Systems and Control II
6.413 Digital Control
6.432 Computer Control and Instrumentation
6.483 Biomedical Engineering
6.512 Advanced Semiconductor Device Theory
6.522 Transistor and Integrated Circuit Design
6.607A Computer Hardware Architecture
6.607B Advanced Software Technology
6.612 Computer Systems Engineering
6.622 Computer Application and Systems

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

Prerequisites and Co-requisites

See Table next page.

Prerequisites and Co-requisites

Full-time Bachelor of Engineering Degree Course

Year	Subject	Prerequisites	Co-requisites
1	1.961	See Matriculation and Admission Requirements	
	2.121		
	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	1.961, 10.001	10.2111, 10.2112
	1.982		
	6.021A	1.961, 6.010, 10.001	
	6.021B	6.021A attempted	
	6.021C	1.982, 6.021A	
	6.021D	Computing strand of 5.030.	
	6.021E	10.001	
	10.111A	10.001	
	10.1113	10.001	
	10.1114	10.001	
	10.2111	10.001	
	10.2112	10.001	
	6.620	10.001	
	6.641‡	6.620 *or* 6.021D *or* 6.621	
3	1.012	1.961, 10.001	10.2111, 10.2112
	6.056	10.2111, 10.2112, 1.961	
	10.033	10.111A, 10.1113, 10.1114, 10.2111, 10.2112	
	10.361	10.001	
	6.0311	6.021A, 6.021B, 6.021C† 10.111A, 10.1113, 10.1114, 10.2111, 10.2112*	
	6.0312	6.021A, 6.021B	6.0311
	6.0313	6.021A, 6.021C	6.0311
	6.0314	6.0311	
	6.0315	6.0312 attempted	
	6.0316	6.0313	6.021E, 6.0311
	6.0317	6.0311	10.361
	6.0318	6.021D *or* 6.620, 6.021E *or* 6.631, 6.021C	
4	6.041	6.0311, 6.0313 (not offered in 1981)	
	6.042	10.033, 10.361	
	6.044	10.361	
	6.045	6.0313	
	6.202	6.0312, 6.0315	
	6.203	6.202	
	6.212	6.0312, 6.0315	
	6.222	6.0315	
	6.303	6.0311, 6.0316, 6.0317	
	6.313	6.303	
	6.322	6.0313, 6.0316	
	6.323	6.0317, 10.033, 10.361	
	6.333	6.0316, 6.0317	
	6.412	6.0311, 6.0314	
	6.413	6.412	
	6.432	6.021D, 6.021E, 6.0314, 6.0316	
	6.483	6.0311, 6.0313, 6.0314, 6.0316	
	6.512	6.0313	
	6.522	6.0313, 6.0316	
	6.607A	6.0318, 6.632, 6.642, 6.643**	
	6.607B		
	6.612	6.021E, *or* 6.631	
	6.622	6.620 *or* 6.021D *or* 6.621	
	6.632	6.021E, 6.641	
	6.647	6.641	
	6.911	(in graduating program only)	

*Two of 10.1113, 10.1114, 10.2111, *or* 10.2112 may be taken as co-requisites.
**At an acceptable level.
†One of 6.021B or 6.021C may be taken as a co-requisite.
‡Not available in full-time course after 1981.

3650
Electrical Engineering

Bachelor of Science (Engineering)
BSc(Eng)

Stage 1

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

Stage 2

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

Stage 3

1.972	Electromagnetism	0	4
1.982	Solid State Physics	4½	0
6.021B	Power	4	0
6.0311	Circuit Theory II	0	4
10.111A	Pure Mathematics II — Lineaar Algebra	2	2
10.2111	Applied Mathematics II — Vector Calculus	2½	0
10.2112	Applied Mathematics II — Mathematical Methods for Differential Equations	0	2½
	One General Studies Elective	1½	1½
		14½	14

Stage 4

1.012	Mechanics and Thermal Physics†	5	0
6.056	Mechanical Engineering†	4	0
6.021C	Electronics I	4	0
6.021D	Computing	4	0
6.021E	Digital Logic & Systems	0	4
6.0312	Utilization of Electrical Energy	0	4
6.0313	Electronics II	0	4
	One General Studies Elective	1½	1½
		14½	13½

†Each student takes one of these technical electives.

Stage 5

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

Stage 6

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

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

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

**6.921 Project: The project involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar and submit a written report. The project should represent the equivalent of a minimum 100 hours of directed laboratory work. If facilities are not available for this to be done largely at work, this may require attendance at the University, full-time in final session, or one further part-time session.

Course Rules

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

- no students will lose credit for any subject completed,

and

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

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

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

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

Re-enrolment

Students must collect enrolment information from the School Office before the end of Session 2 1980. Re-enrolment forms, giving details of students' proposed 1981 programs must be lodged with the School Office by Wednesday 7 January 1981. Enrolment at the University will not be authorized until the re-enrolment form has been checked and the program approved.

Electrical Engineering — Substitution of Subjects

To suit the special abilities or needs of individual students a limited amount of substitution is permitted within each course. Any such substitution *must have prior approval of the Head of School* who will ensure that:

1. The replacement subject is *at least* of the same length and level as the prescribed subject it replaced; and

2. The resulting overall program of study is suited to the award of either the BE or BSc(Eng) degree as applicable.

Examples are:

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

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

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

(4) The normal Year 4 of the BE degree program includes 5 units (6 units in 1981) of Electrical Engineering IV. Students may substitute for *one* of these units, a subject of suitable level and difficulty from an area outside the School of Electrical Engineering and Computer Science.

(5) Students proposing to major in Computer Science in the BE program may substitute appropriate Computer Science units in Year 4 (for some professional electives).

Double Degrees

3970/3640 Double Degree of BSc BE in Electrical Engineering

Students in Electrical Engineering may qualify for the award of this double degree in five years of full-time study. Having completed the first and second year of the Electrical Engineering course, students *with a creditable performance* may transfer to the Science and Mathematics Course (this is subject to the recommendation of the Head of the School of Electrical Engineering and Computer Science *and* the approval of the Faculty of Engineering *and* the Board of Studies in Science and Mathematics). In the Science and Mathematics Course, students take the appropriate General Studies subjects and complete a specific course of study consisting of four Level III units chosen from related disciplines and no less than either four other Level II or Level III units. The specific courses of study available for this double degree are shown in the Combined Sciences Handbook and lead to majors in computer science, mathematics or physics. **Students contemplating a major in Computer Science should seek advice from the Head of School before enrolling in Year 1. Students intending to major in Mathematics or Physics should contact the School before completing their Year 2 enrolment.**

In their fourth year the students revert to the Faculty of Engineering. Depending on the program followed in their year in Science they will have already completed parts of the normal third year program of the Electrical Engineering course, and they will be required to omit these from their program and to include an equivalent amount of other courses chosen with the approval of the Head of School. Students who choose to omit the General Studies elective 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 3 session-hours of other material in lieu of the General Studies elective requirement. In their fifth year they will complete the fourth year of the Electrical Engineering course.

3720 Double Degree BA BE in Electrical Engineering

The double degree BA BE in Electrical Engineering may be gained by a five-year course of combined study. Students wishing to enrol for this double degree may do so: by initially enrolling as a student proceeding to the double degree, or by transferring to the BA BE program with advanced standing after partially completing the requirements for 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 and Computer Science, the relevant schools in the Faculty of Arts and the Arts Faculty Office.

Initial Enrolment for BA BE

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

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

Table A*

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

*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.

Major in Computer Science within the Science and Mathematics Course

The Science and Mathematics Course (3970), which leads to the award of the Bachelor of Science degree, is administered by the Board of Studies in Science and Mathematics and offers a wide choice of programs, each designed to meet specific aims and objectives. There are six specialized programs leading to the award of a BSc degree majoring in Computer Science. All students enrol in program 6806 in Year 1 (see below) and transfer to one of the programs 0601, 0603, 0604, 0605, 0610 or 0611 in Year 2.

6806

Year 1

10.001 or 10.011
6.611
5 other units as prescribed

For further details see the Combined Sciences Handbook.

School of Mechanical and Industrial Engineering

Head of School
Professor N. L. Svensson

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

Senior Administrative Officer
Mr G. Dusan

The courses in the School are planned to provide the appropriate academic training for the professional engineer in the fields of aeronautical, industrial and mechanical engineering, and for the naval architect. They may be taken either on a full-time basis, nominally over four years, or on a part-time basis, nominally over six years, or on a combined full-time/part-time basis, subject to the approval of the Head of School.

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

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

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

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

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

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

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

Students proceeding to the award of 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 Bachelor of Science (Engineering) earlier in this Handbook.)

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

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

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

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

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

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

3680
Mechanical Engineering — Full-time (New Course)

Bachelor of Engineering
BE

Year 1

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

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

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

Year 2

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

Year 3

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I†	0	0
5.073	Numerical Analysis/Mathematics	3	3
5.123	Mechanical Engineering Design III	3	3
5.333	Dynamics of Machines	0	3
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
	Two Fluid Mechanics/ Thermodynamics Technical Electives	3	3
6.854	Electrical Engineering	0	4
18.603	Management/Economics	4	0
	Two General Studies Electives	3	3
		22½	22½

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

Year 4*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.344	Feedback Control	3	0
	Technical Electives	9	12
	General Studies Elective	1½	1½
		21½	21½

Note 1: At least six hours per week of Technical Electives must be taken from the Mechanical Engineering Technical Elective list. The remaining Technical Electives may be taken from the Industrial Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School. Students with good academic records may include some graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.
Note 2: Only a limited number of Technical Electives is offered each year. The actual Technical Electives offered each year are decided on the basis of staff availability and student demand. Students are advised in September of each year which Technical Electives will be offered in the following year.
*Not offered in 1981.

Year 2*

		Hpw S1	S2
5.032	Experimental Engineering II	2	2
5.111	Mechanical Engineering Design I	2	4
5.330	Engineering Dynamics	2	2
5.411	Mechanics of Solids II	2	2
5.611	Fluid Mechanics/ Thermodynamics	4	4
6.801	Electrical Engineering	3	3
8.259	Properties of Materials	3	3
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½
18.020	Industrial Orientation	0	1
		23½	26½

*Not offered in 1981.

Year 3**

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

†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.
*One session only. Students must take this subject in either Session 1 or Session 2.
**Not offered in 1981.

3680
Mechanical Engineering — Full-time (Old Course)

Bachelor of Engineering
BE

Year 1*

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

Year 4

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

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

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

3680
Mechanical Engineering — Part-time (New Course)

Bachelor of Engineering
BE

Year 1

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

Year 2

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

Year 3

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

Year 4

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

Year 5*

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

*Not offered in 1981.

Year 6*

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

*Not offered in 1981.

Note 1: By the end of Stage Six the equivalent of 10½ hours per week for a year of Technical Electives must have been completed. The equivalent of at least six hours per week of Technical Electives must be taken from the Mechanical Engineering Technical Elective list. The remaining Technical Electives may be taken from the Industrial Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School. Students with good academic records may include som graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.

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

3690
Mechanical Engineering — Part-time (Old Course)

Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 1*

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

*Not offered in 1981.

Stage 2*

		Hours per week S1	S2
2.951	Chemistry I (ME)	0	6
5.010	Engineering A	6	0
5.030	Engineering C	6	0
5.040	Engineering D	0	8

*Not offered in 1981.

Stage 3

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

Stage 4

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

Stage 5

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

Stage 6

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

Plus one of the following technical electives:

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

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

Mechanical Engineering Technical Elective List

Applied Mechanics Technical Electives

		Hpw S1		S2
5.321G	Analogue Control Systems	0		3
5.332	Dynamics of Machines II	3		3
5.334	Engineering Dynamics II	3	*or*	3
5.3541	Engineering Noise I	3		0
5.3542	Engineering Noise II	0		3

Mechanics of Solids Technical Electives

5.413.	Mechanics of Solids IV	3		3
5.417G	Mechanics of Fracture and Fatigue	3	*or*	3
5.424	General Mechanics of Solids	3	*or*	3
5.434	Plates and Shells	3	*or*	3
5.444	Theory of Elasticity	3	*or*	3
5.454	Theory of Plasticity	3	*or*	3
5.464	Structural Instability	2		0

Mechanical Design Technical Electives

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

Fluid Mechanics/Thermodynamics Technical Electives

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

Other Technical Electives

		Hours per week S1	S2
4.913	Materials Science	3	3
5.074	Computing Science for Mechanical Engineers	3	0
5.811	Aerodynamics I	3	3
5.831	Aircraft Propulsion	2	2
18.012	Industrial Engineering IIA	3	3
18.022	Industrial Engineering IIB	3	3
18.431	Design for Production	3	3
18.551	Operations Research	3	3
23.051	Nuclear Power Technology	3	3

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

Year 4*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design II	3	3
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
5.831	Aircraft Propulsion	2	2
	Technical Electives	3	3
	General Studies Elective	1½	1½
		22½	22½

*Not offered in 1981.

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

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

3610
Aeronautical Engineering — Full-time (New Course)

Bachelor of Engineering
BE

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

Year 3

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I†	0	0
5.073	Numerical Analysis/Mathematics	3	3
5.303	Mechanical Vibrations	0	1½
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
5.800	Aircraft Design I	3	3
5.811	Aerodynamics I	3	3
5.822	Analysis of Aerospace Structures I	2	2
6.854	Electrical Engineering	0	4
18.603	Management/Economics	4	0
	Two General Studies Electives	3	3
		24½	23

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

3610
Aeronautical Engineering — Full-time (Old Course)

Bachelor of Engineering
BE

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

Year 3**

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

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

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

**Not offered in 1981.

Year 4

		Hours per week S1	S2
5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.801	Aircraft Design	4	4
5.812	Aerodynamics II	3	3
5.823	Analysis of Aerospace Structures II	2	2
5.831	Aircraft Propulsion	2	2
	General Studies Elective	1½	1½
Plus one of the following technical electives:			
4.913	Materials Science *or*		
5.324	Automatic Control Engineering *or*		
8.026	Systems Methods in Civil Engineering *or*	3	3
18.022	Industrial Engineering IIB *or*		
18.551	Operations Research		
		23½	23½

Year 5*

		Hours per week S1	S2
5.034	Engineering Experimentation	1½	1½
5.043	Industrial Training I	0	0
5.800	Aircraft Design I	3	3
5.822	Analysis of Aerospace Structures I	2	2
5.831	Aircraft Propulsion	2	2
18.603	Management/Economics	4	0
	Technical Electives	3	3
	General Studies Elective	0	3
		15½	14½

*Not offered in 1981.

Year 6*

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

*Not offered in 1981.

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

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

3610
Aeronautical Engineering — Part-time (New Course)

Bachelor of Engineering
BE

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

Year 4

		Hours per week S1	S2
5.073	Numerical Analysis/Mathematics	3	3
5.303	Mechanical Vibrations	0	1½
5.343	Linear Systems Analysis	3	0
5.423	Mechanics of Solids III	2	2
5.811	Aerodynamics I	3	3
6.854	Electrical Engineering	0	4
	General Studies Elective	1½	1½
		12½	15

3600
Aeronautical Engineering — Part-time (Old Course)

Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 5

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

Stage 6

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

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

Year 3

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

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

Year 4*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
5.922	Ship Structures II	2	2
5.9321	Principles of Ship Design II	4	2
5.937	Ship Design Project	3	4
5.941	Ship Propulsion and Systems	4	4
	General Studies Elective	1½	1½
		22½	21½

*Not offered in 1981.

3700
Naval Architecture — Full-time (New Course)

Bachelor of Engineering
BE

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

3700
Naval Architecture — Full-time (Old Course)

Bachelor of Engineering
BE

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

two-year program leading to the Bachelor of Engineering degree in Naval Architecture.

Year 3*

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

†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.
*Not offered in 1981.

Year 4

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

Year 4

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

Year 5*

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

*Not offered in 1981.

Year 6*

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

*Not offered in 1981.

3700
Naval Architecture — Part-time (New Course)

Bachelor of Engineering
BE

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

3710
Naval Architecture — Part-time (Old Course)

Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 5

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

Stage 6

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

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

Department of Industrial Engineering

The Department of Industrial Engineering offers a course in Industrial Engineering leading to the award of the degree of Bachelor of Engineering. This course is designed for students with engineering ability whose interests lie in the planning, developing and control of manufacturing or service operations. It may be taken either on a full-time basis, nominally over four years or on a part-time basis, nominally over six years, or on a combined full-time/part-time basis, subject to the approval of the Head of School.

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

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

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

The Work of the Industrial Engineer

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

1. Industrial Economic Analysis

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

2. Planning and Control of Production

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

The ultimate responsibility of those in charge of the planning and control of production is to ensure that the goods, as originally specified, perform satisfactorily and are produced when required at an optimum cost. Modern electronic computers may be called upon to help achieve this.

3. Product and Process Design

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

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

4. Methods Engineering

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

5. Operations Research

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

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

Year 3

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

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

Year 4*

5.044	Industrial Training II	0	0
5.051	Thesis	6	6
5.062	Communications	2	2
18.004	Manufacturing Management	2	2
	Technical Electives	10	10
	General Studies Elective	1½	1½
		21½	21½

*Not offered in 1981.

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

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

3660
Industrial Engineering — Full-time (New Course)

Bachelor of Engineering
BE

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

3660
Industrial Engineering — Full-time (Old Course)

Bachelor of Engineering
BE

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

Year 3*

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

†Report to be submitted in Week 1 of Session 1 detailing involvement and experience gained prior to Year 3.
*Not offered in 1981.

Year 4

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

Year 4

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

Year 5*

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

*Not offered in 1981.

Year 6*

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

*Not offered in 1981.

3660
Industrial Engineering — Part-time (New Course)

Bachelor of Engineering
BE

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

Note 1: By the end of Stage Six, the equivalent of 10 hours per week for a year of Technical Electives must have been completed. The equivalent of at least 6 hours per week for a year of Technical Electives must be taken from the Industrial Engineering Technical Elective List. The remaining Technical Electives may be taken from the Mechanical Engineering Technical Elective List or from Years 3 or 4 of other courses in the School or suitable subjects outside the School. Students with good academic records may include some graduate subjects. A counselling service is provided to assist students to choose electives. The selection of certain subjects or combinations of subjects may require the approval of the Head of School.

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

3670
Industrial Engineering — Part-time (Old Course)

Bachelor of Science (Engineering) BSc(Eng)

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

Stage 5

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

Stage 6

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

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

Industrial Engineering Technical Elective List

Production Engineering Technical Electives

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

Operations Research Technical Electives

		Hours per week S1		S2
18.671G	Decision Theory	2	*or*	2
18.764G	Management of Distribution Systems	2	*or*	2
18.765G	Optimization of Networks	2	*or*	2
18.777G	Time Series and Forecasting	2	*or*	2
18.864G	Applied Geometric Programming	2	*or*	2
18.874G	Dynamic Programming	2	*or*	2
18.878G	Industrial Application of Mathematical Programming	2	*or*	2

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

School of Surveying

Head of School
Professor P. V. Angus-Leppan

Adminstrative Officer
Mr J. V. Fonseka

The School of Surveying offers a full-time course of four years' duration leading to the award of the degree of Bachelor of Surveying. Alternatively, the course may be taken in a Sandwich form in which a student may, after completing the first year of the course on a full-time basis, alternate his or her studies with periods of employment by taking leaves of absence of up to two consecutive sessions at a time thereafter. The course taken in this form requires a maximum period of seven years. The part-time course is no longer available.

The Bachelor of Surveying is a well-rounded course with a strong surveying base, aimed at preparing the graduate for a broad range of career opportunities, including land boundary surveying, engineering surveying, photogrammetry, cartography, mining surveying, hydrographic surveying, geodesy and geodetic surveying, computing and systems development, management and development of land, land information systems 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 recently. Features of the revision include: retention of the course on a session basis for all subjects lectured within the School; integration of the sandwich course with the full-time course as

a result of the more flexible University policy towards leave of absence for students; elimination of the formally assessed professional training period in the earlier course; greater numbers of technical electives in the fourth year of study; further development of the Land Studies area: land development, inventory, law, tenure, and utilization, in continuing recognition of the growing importance of this area to surveyors; development of a formal strand to improve students' written and spoken communication skills.

Throughout the course the theoretical studies are complemented by practical exercises in the field and the laboratory. Students make use of the most modern measuring instruments and computing equipment.

From 1981 onwards the School also offers a full-time course of four years' duration leading to the award of the degree of Bachelor of Surveying Science. The new course is designed to give an interested student the opportunity to obtain greater depth as an undergraduate in one or more of the several disciplines associated with surveying: land development, cartographic science, geodesy and geophysics, environmental studies, remote sensing and photogrammetry. It is so structured that:

1. All students must take a core consisting of 103 contact hours made up from some of the subjects of the Bachelor of Surveying course. These core subjects include the formal strands in Mathematics, Physics, Physical Geography, Surveying, written and spoken communication, and 12 hours of General Studies.

2. The balance, totalling 77 hours, must comprise:

a) at least 18 hours taken from elective subjects of the final year of the Bachelor of Surveying course;

b) the remainder made up from any subjects required as prerequisites for a) above *and* any combination of subjects offered by the University and approved by the Head of School for the individual program of study. Such approval would require that the student follow a particular sequence of subjects within a given subject area. Subjects offered by Sydney University and Macquarie University may also be taken subject to approval by the Head of School.

3. Resolution of class scheduling problems is the responsibility of the student.

Bachelor of Surveying students in their latter years of study may elect to transfer to the new course if they so desire.

The Bachelor of Surveying or the Bachelor of Surveying Science degree may be awarded as a Pass degree, Honours Class I, or Honours Class II in two divisions. Honours are awarded in recognition of superior performance throughout the course.

Students wishing to become Registered Surveyors after graduation are advised to gain practical experience under a Registered Surveyor. Some reduction in the period of practical experience required before registration may be granted because of practical experience gained during the University course, provided the New South Wales Surveyors' Board is informed in the prescribed manner. Details are obtainable from the Registrar, Surveyors' Board, Department of Lands, Bridge Street, Sydney 2000. The degree of Bachelor of Surveying confers exemption from all written examinations of the Surveyors' Board. In the case of the Bachelor of Surveying Science degree the New South Wales Surveyor's Board may require additional subjects for registration.

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

3740 Surveying

Bachelor of Surveying BSurv

Year 1

Session 1

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

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

Session 2

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

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

Year 2

Session 1

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

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

Session 2

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

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

Year 3

Session 1

29.005	Surveying V	5
29.152	Survey Computations II	4
29.631	Land Inventory I	2
29.651	Land Development I	3
29.661	Cadastral Surveying and Land Law I	2
36.411	Town Planning	2
	General Studies Elective	3
		21

Session 2

8.712	Engineering for Surveyors II	3
29.006	Surveying VI	3
29.211	Geodesy I	4
29.311	Astronomy I	3
29.511	Photogrammetry I	4
29.652	Land Development II	3
29.662	Cadastral Surveying and Land Law II	3
29.195	Survey Camp III**	6
		29

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

Year 4

Session 1

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

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

Session 2

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

*See Year 4: Electives, below.

Year 4: Electives

Total of two General Studies Advanced Electives and five technical electives in any combination which results in 6 hours for Session 1 and 15 hours for Session 2. Technical electives (of 3 hours per week each, except 29.174) are chosen from:

29.031 Electronic Distance Measurement
29.032 Precise Surveying in Industry and Engineering
29.033 Charactistics of Modern Theodolites and Levels
29.034 Mine Surveying
29.035 History of Surveying
29.153 Adjustment of Control Surveys
29.161 Hydrographic Surveying I
29.162 Hydrographic Surveying II
29.173 Project
29.174 Major Project (6 hours per week)
29.213 Geodesy III
29.231 Geophysics for Surveyors
29.232 Atmospheric Effects on Geodetic Measurement
29.313 Astronomy III
29.513 Photogrammetry III
29.514 Remote Sensing Principles
27.173 Remote Sensing Applications
29.654 Land Development IV
29.632 Land Inventory II
29.663 Cadastral Surveying and Land Law III
29.664 Modern Title Concepts
29.802 Cartography II
29.803 Mapping Technology

Not all electives are offered in any one year. Subjects from other Schools and Faculties may be substituted with the approval of the Head of School.

3760
Surveying Science

Bachelor of Surveying Science
BSurvSc

The course consists of a mandatory program of 103 class contact hours including a General Studies program of 12 hours and an Elective Program of at least 77 hours. A student may undertake in any one session a load generally not exceeding 24 hours, comprising subjects from one or more of these programs, provided they are taken in sequence within each subject area and in accordance with their prerequisite and/or co-requisite requirements.

Mandatory Program

The mandatory program consists of the following subjects:

		Hours per week	
1.971	Physics I	12	
10.011	Mathematics I	12	
29.001	Surveying I	4½	*
29.002	Surveying II	5	*
29.191	Survey Camp I	3	*
29.700	Professional Orientation	1½	*
1.962	Physics of Measurement**	3	
10.022	Engineering Mathematics**	8	
10.341A and B	Statistics S.U. Parts A and B**	4	
27.295	Physical Geography for Surveyors**	4	
29.003	Surveying III	5	†
29.121	Electronics for Surveyors**	2	†
29.151	Survey Computations I	4	†
29.701	Seminar I	1	†
29.801	Cartography I	3	†
29.152	Survey Computations II	4	‡
29.211	Geodesy I	4	‡
29.511	Photogrammetry I	4	‡
29.702	Seminar II	1	§
29.703	Seminar III	1	§
6.600	Introduction to Computing	5	
		91	

*Offered in Year 1 of the BSurv Course (3740).
†Offered in Year 2 of the BSurv Course (3740).
‡Offered in Year 3 of the BSurv Course (3740).
§Offered in Year 4 of the BSurv Course (3740).
**May be replaced by a similar subject at least equal in coverage of the topic. Any resulting additional contact hours may be used in satisfying the Elective Program.

General Studies Program

This program consists normally of 4 General Studies subjects of 3 hours each (or their equivalent) and may be undertaken at any time during Years 2-4 of the Course, subject to the total load for a session (which as a rule should not exceed 24 hours).

Elective Program

This program consists of at least 18 hours (or 6 technical electives) selected from elective subjects of the final year of the BSurv course plus any subjects required as prerequisites for these electives *and* any combination of subjects offered by this University, the University of Sydney or Macquarie University provided that they are approved by the Head of School for the individual program of study. Such approval would require that a student follows a particular sequence of subjects within a selected area. This prescription means in effect that the elective component of the course can be varied to enable the student to choose the specialization that best suits his individual requirements so long as such specialization falls within the general disciplines associated with Surveying. Electives for such specialization may be chosen, for instance, from subject areas such as:

Cartography and Mapping Technology
Geography, Geograpic Data Analysis, Mathematical Methods for Spatial Analysis
Town, Urban and Neighbourhood Planning
Geodesy, Geology, Earth Physics, Oceanography and Marine Science
Astronomy
Photogrammetry, Remote Sensing
Land Law, Title Concepts, Cadastral Surveying
Land Inventory
Land Development and Management
Building Economics
Accounting and Computer Applications

Illustrative examples of programs that could be taken are available from the School.

Graduate Study

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1981 or enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1981* available from School Offices and the Admissions Office. This booklet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Graduate School of Engineering

In November 1964 Council approved the establishment of the Graduate School of Engineering to co-ordinate and develop the graduate activities of the Faculty. For full details of such activities see brochures prepared by the Schools.

Research Degrees

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

Course Work Degrees

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

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

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

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

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

Graduate Diploma

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

are Graduate Diplomas in Engineering Developments; in Highway Engineering; in Human Communication; in Surveying; and in Transport. Candidates must complete a program totalling 30 credits. Forty percent of the credits may consist of approved undergraduate subjects and the program may contain subjects from other schools of the Faculty, other faculties of the University, and other universities or institutions.

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

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

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

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

Graduate Subjects

The subjects which may be available for a candidate proceeding to the award of the degree of Master of Engineering Science, Master of Surveying Science, Master of Biomedical Engineering and Graduate Diploma are listed below under the various schools. Not all electives are necessarily offered in any particular year.

Under the credit system in operation in the Faculty, one credit is normally equal to one hour's attendance per week for one session. The qualification 'normally' is required because of the varying ways in which credits are distributed for course work, design, critical review or research in the different schools.

School of Civil Engineering

		Credits
8.401G	Human Factors in Transport	3
8.402G	Transport, Environment, Community	6
8.403G	Theory of Land Use/Transport Interaction	3
8.404G	Local Area Transport Planning	3
8.405G	Urban Transport Planning Practice	3
8.406G	Regional Transport Planning	3
8.407G	Transport System Design (Non-Urban)	3
8.408G	Transport System Design (Urban)	3
8.409G	Interchange Design	3
8.410G	Highway Engineering Practice Part I	3
8.411G	Highway Engineering Practice Part II	3
8.412G	Economics for Transport Studies	3
8.413G	Transport Economics	3
8.414G	Transport Systems Part I	3
8.415G	Transport Systems Part II	3
8.416G	Traffic Engineering	6
8.417G	Transport and Traffic Flow Theory	6
8.418G	Statistics for Transport Studies Part I	3
8.419G	Statistics for Transport Studies Part II	3
8.420G	Transport Engineering Elective	3

These subjects were offered previously by the School of Transport and Highways with the prefix 24.001G, 24.002G, etc.

8.701G	Economic Decision Making in Civil Engineering	3
8.702G	Network Methods in Civil Engineering	3
8.703G	Optimization Techniques in Civil Engineering	3
8.704G	Stochastic Methods in Civil Engineering	3
8.705G	Systems Modelling	3
8.706G	Experimental Methods in Engineering Research	3
8.710G	Advanced Topics in Optimization in Civil Engineering	3
8.714G	Advanced Topics in Systems Modelling	3
8.723G	Construction Design	3
8.724G	Construction Technology	3
8.725G	Construction Accounting and Control	3
8.726G	Construction Law and Professional Practice	3
8.727G	Construction Planning and Estimating	6
8.728G	Design of Construction Operations	6
8.748G	Pavement Materials I	3
8.749G	Pavement Materials II	3
8.750G	Pavement Design and Evaluation I	3
8.751G	Pavement Design and Evaluation II	3
8.752G	Terrain Engineering	6
8.753G	Soil Engineering	3
8.754G	Applied Soil Mechanics	3
8.755G	Materials of Construction (Concrete Technology) I	3
8.758G	Soil Mechanics	3

		Credits
8.760G	Materials of Construction (Concrete Technology) II	3
8.764G	Composites in Civil Engineering	3
8.766G	Welding in Structural Engineering	3
8.771G	Foundation Engineering	6
8.773G	Materials of Construction (Metals) III	3
8.774G	Soil Dynamics	3
8.775G	Geotechnical Aspects of Natural Hazards	3
8.776G	Rock Mechanics	3
8.777G	Numerical Methods in Geomechanics	3
8.778G	Geotechnical Processes for Energy Resources	3
8.780G	Geological Engineering	3
8.802G	Elastic Stability I	3
8.803G	Elastic Stability II	3
8.804G	Vibration of Structures I	3
8.805G	Vibration of Structures II	3
8.806G	Prestressed Concrete I	3
8.807G	Prestressed Concrete II	3
8.808G	Prestressed Concrete III	3
8.809G	Reinforced Concrete I	3
8.810G	Reinforced Concrete II	3
8.811G	Reinforced Concrete III	3
8.812G	Plastic Analysis and Design of Steel Structures I	3
8.813G	Plastic Analysis and Design of Steel Structures II	3
8.814G	Analysis of Plates and Shells	3
8.817G	Experimental Structural Analysis I	3
8.818G	Bridge Design I	3
8.819G	Bridge Design II	3
8.820G	Structural Analysis and Finite Elements I (SAFE I)	3
8.821G	Structural Analysis and Finite Elements II (SAFE II)	3
8.822G	Structural Analysis and Finite Elements III (SAFE III)	3
8.830G	Hydromechanics	3
8.831G	Closed Conduit Flow	3
8.832G	Pipe Networks and Transients	3
8.833G	Free Surface Flow	3
8.835G	Coastal Engineering I	3
8.836G	Coastal Engineering II	3
8.837G	Hydrological Processes	3
8.838G	Flood Design	3
8.839G	Advanced Flood Estimation	3
8.840G	Reservoir Design and Yield Determination	3
8.841G	Hydrometeorology	3
8.842G	Groundwater Hydrology	3
8.843G	Groundwater Hydraulics	3
8.844G	Soil-Water Hydrology	3
8.846G	Urban Drainage Design	3
8.847G	Water Resources Policy	3
8.848G	Water Resources System Design	3
8.849G	Irrigation	3
8.850G	Drainage of Agricultural Lands	3
8.851G	Unit Operations in Public Health Engineering	3
8.852G	Water Distribution and Sewage Collection	3
8.854G	Solid and Liquid Waste Management	2
8.855G	Water and Wastewater Analysis and Quality Requirements	3
8.856G	Water Treatment	3
8.857G	Sewage Treatment and Disposal	3
8.858G	Water Quality Management	3
8.860G	Investigation of Groundwater Resources I	3
8.861G	Investigation of Groundwater Resources II	3
8.862G	Fluvial Hydraulics	3
8.863G	Estuarine Hydraulics	3
8.901G	Civil Engineering Elective I	3
8.902G	Civil Engineering Elective II	3
8.909G	Project	9
8.918G	Research Project	18
8.936G	Research Project*	36

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

School of Electrical Engineering and Computer Science

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

6.050G	Occasional Elective — Reliability Engineering II
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 — Applied Optoelectronics
6.160G	Field Theory in Electrical Engineering
6.161G	Field Mapping
6.164G	Microwave Antenna Theory and Applications
6.169G	Microwave Circuits: Theory and Techniques
6.170G	Microwave Electronics
6.224G	Electrical Insulation Engineering
6.225G	Electrical Discharges and their Technical Applications
6.226G	Electrical Apparatus Design
6.227G	Assessment of Insulation Performance in Electrical Plant
6.228G	Power System Equipment
6.234G	Power System Protection
6.246G	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
6.256G	Underground Systems
6.257G	Electric Power Distribution Systems
6.336G	Digital Communication Networks
6.337G	Sound Broadcast Systems
6.338G	Television Systems
*6.339G	Electroacoustics

6.344G	Communication Theory	
6.345G	Analogue and Digital Filters	
6.347G	Digital Communications	
6.348G	Optical Communications	
6.349G	Radar and Navigation Aids	
6.350G	Solid State Electronics Elective	
6.373G	Semiconductor Devices	
6.375G	Integrated Circuit Technology	
6.376G	Reliability Engineering	
6.377G	Integrated Circuit Design	
6.378G	Solar Energy Conversion	
6.379G	Solar Cells — Operating Principles, Technology and System Applications	
6.380G	Data Acquisition and Analysis in Remote Sensing	
6.433G	Applied Microprocessor Design	
6.453G	Computer Methods of Optimization	
6.455G	System Identification and Modelling	
6.456G	General Concepts in Formal System Theories	
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	
6.459G	Control Computing	
6.460G	Real Time Computing and Simulation	
6.464G	Applied Optimal Estimation and Prediction	
6.466G	Computer-Aided Design of Multivariable Control Systems	
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	
6.468G	Computer Display Systems and Interactive Instrumentation	
6.470G	Advanced Topics in Control	
6.471G	Systems and Control Elective	
6.484G	Biological Signal Analysis	
6.485G	Medical Instrumentation	
6.650G	Computer Science Elective	
6.651G	Digital Electronics	
6.654G	Digital Systems	
6.655G	Computer Organization and Architecture	
6.656G	Software Systems A	
6.657G	Software Systems B	
10.061G	Advanced Mathematics I	
10.361G	Statistics	
†6.909G	Project	9 credits
6.918G	Research Project	18 credits
6.936G	Research Project	36 credits

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

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	Computations Methods in Mechanical Engineering I, II	2,2
5.077-8G	Analogue Computation in Mechanical Engineering I, II	2,2
5.086G	Digital Logic Fundamentals for Mechanical Engineers	3
5.087G	Microprocessor Fundamentals for Mechanical Engineers	3
5.088G	Industrial Applications of Microprocessors	3
*5.151-2G	Refrigeration and Air Conditioning Design I, II	3,3
5.304-5G	Advanced Dynamics I, II	2,2
5.315-6G	Mechanisms I, II	2,2
5.317G	Industrial Robotics	3
*5.321-2G	Automatic Control I, II	2,2
5.328-9G	Control and Modelling of Mechanical Systems I, II	3,3
5.335G	Vibrations	2
5.336G	Random Vibrations	2
5.401G	Experimental Stress Analysis	2
5.415-6G	Stress Analysis for Mechanical Engineering Design I, II	3,3
5.417G	Mechanics of Fracture and Fatigue	3
5.428G	Advanced Mechanics of Materials	2
5.491-2G	Biomechanics I, II	2,2
5.601G	Computational Fluid Dynamics	2
5.616-7G	Internal Combustion Engines I, II	3,3
5.621-2G	Gasdynamics I, II	2,2
5.631-2G	Lubrication Theory and Design I, II	2,2
5.653-4G	Acoustic Noise I, II	2,2
*5.712-3G	Convection Heat Transfer I, II	2,2
5.718G	Conduction Heat Transfer	2
5.719G	Radiation Heat Transfer	2
5.720G	Solar Collector Systems	2
5.725G	Statistical Thermodynamics	2
5.735G	Direct Energy Conversion	2
*5.751-2G	Regrigeration, Air Conditioning and Cryogenics I, II	2,2
*5.758G	Refrigeration and Air Conditioning Applications	4
5.909G	Project	9
5.912-3G	Naval Hydrodynamics I, II	2,2
5.918G	Research Project	18
†5.936G	Research Project	36

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

Department of Industrial Engineering

		Credits
*18.061G	Industrial Experimentation I	3
*18.062G	Industrial Experimentation II	3
*18.073G	Ergonomics	2

		Credits
18.074G	Industrial Management	3
*18.171G	Inspection and Quality Control	3
*18.260G	Computer Aided Programming for Numerical Control	3
*18.261G	Computer Automation	3
*18.262G	Economics of Machining for Automation	3
*18.271G	Theory of Machining and Forming Processes	3
*18.272G	Technology of Machining and Forming Processes	3
*18.370G	Design of Work Systems	3
*18.371G	Factory Design and Layout	3
*18.461G	Design for Production	4
*18.462G	Industrial Design	2
*18.463G	Tool Design	4
*18.464G	Value Analysis/Engineering	3
*18.471G	Design Communication	2
*18.472G	Engineering Design Analysis	6
18.571G	Operations Research I	6
18.574G	Operations Research II	3
18.579G	Case Studies in Operations Research	3
18.671G	Decision Theory	2
18.675G	Economic Decisions in Industrial Management	3
18.761G	Simulation in Operations Research	3
18.763G	Variational Methods in Operations Research	2
18.764G	Management of Distribution Systems	2
18.765G	Optimization of Networks	2
18.770G	Stochastic Control	2
18.772G	Information Processing Systems in Organizations	2
18.774G	Applied Stochastic Processes	2
18.775G	Networks and Graphs	2
18.776G	Production and Inventory Control	2
18.777G	Time Series and Forecasting	2
18.778G	Scheduling and Sequencing	2
18.779G	Game Theory	2
18.862G	Linear Programming	2
18.863G	Non-Linear Programming	2
18.871G	Mathematics for Operations Research	2
18.874G	Dynamic Programming	2
18.875G	Geometric Programming	2
18.876G	Advanced Mathematics for Operations Research	2
18.877G	Large-scale Optimization	2
18.878G	Industrial Applications of Mathematical Programming	2
18.879G	Mathematical Programming Analysis	3
18.960G	Production Engineering Seminar	0
18.965G	Industrial Management Seminar	0
18.967G	Advanced Topic in Production Engineering	2
18.968G	Advanced Topic in Production Engineering	2
18.969G	Advanced Topic in Production Engineering	2
18.970G	Operations Research Seminar	0
18.977G	Advanced Topic in Operations Research	2
18.978G	Advanced Topic in Operations Research	2
18.979G	Advanced Topic in Operations Research	2
18.909G	Project	9
18.918G	Research Project	18
†18.936G	Research Project	36

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

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

Note 3: All Master of Engineering Science candidates in the Department of Industrial Engineering must include 18.909G or 18.918G in their program.

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

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

School of Nuclear Engineering

Head of School
Professor J. J. Thompson

Each subject counts as three credits.

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

School of Surveying

		Credits
29.101G	Aspects of Electromagnetic Distance Measurement	3
29.102G	Characteristics of Optical Surveying Instrumentation	3
29.103G	Precise Engineering Surveys	3
29.106G	Special Topic in Surveying A	3

		Credits
29.107G	Special Topic in Surveying B	3
29.151G	Adjustment of Observations	3
29.171G	Mathematical Methods I — Numerical Analysis	3
29.172G	Mathematical Methods II — Statistical Theory of Survey Observations	3
29.173G	Mathematical Methods III — Spherical Harmonics	3
29.174G	Mathematical Methods IV — Theory of Survey Adjustment	3
29.175G	Mathematical Methods V — Collocation	3
29.201G	Geodetic Methods	3
29.202G	Solid Earth, Ocean, Lunar and Planetary Geodesy	3
29.203G	Gravimetric Geodesy	3
29.204G	Geodetic Refraction	3
29.205G	Geodetic Analysis Techniques	3
29.206G	Advanced Geodetic Instrumentation	3
29.207G	Doppler Positioning	3
29.314G	Geodetic Astronomy	6
29.516G	Mathematical Model of the Imaging Process	3
29.517G	Stereophotogrammetry	3
29.518G	Analytical Photogrammetric Orientation	3
29.519G	Photogrammetric Instrumentation	3
29.520G	Photogrammetric Production Processes	3
29.521G	Control Extension A	3
29.522G	Control Extension B	3
29.601G	Remote Sensing Principles and Procedures	6
29.602G	Mass Appraisal Methods	3
29.603G	Statutory Control of Land Development	3
29.604G	Land Information Systems	3
29.706G	Survey Management	3
29.707G	Quantitative Management Methods	3
29.909G	Project	9
29.918G	Research Project	18
29.936G	Research Project	36

Centre for Biomedical Engineering

Director
Associate Professor P. C. Farrell

		Credits
32.012G	Biomedical Statistics	4
32.010G	Biomedical Engineering Practice	2
§32.018G	Research Project	18
32.020G	Radiation Physics	4
§32.030G	Research Project	30
32.101G	Mathematical Modelling for Biomedical Engineers	4
32.311G	Mass Transfer in Medicine	4
32.321G	Fluid Mechanics for Artificial Organs	4
32.331G	Biocompatibility	2
*32.500G	Computing for Biomedical Engineers	3
32.510G	Introductory Biomechanics	3
†32.511G	Mechanics of the Human Body	4
†32.521G	Biomechanics of Physical Rehabilitation	4
†32.531G	Mechanical Properties of Biomaterials	4
32.611G	Medical Instrumentation	3
*32.621G	Biological Signal Analysis	3
72.402G	Principles of Disease Processes	3

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

Graduate Diplomas

Graduate Diploma programs in all schools of the Faculty may include subjects from the above list, subject to the approval of the Head of School responsible for the subject.

In addition the following subjects are offered specifically for Graduate Diploma students. Not all electives are necessarily offered in any particular year.

School of Electrical Engineering and Computer Science

		Credits
6.060G	Microprocessor Systems	3
6.167G	Propagation and Transmission of Electrical Waves	3
6.340G	Communications Electronics	3
6.341G	Signal Analysis	3
6.343G	Digital and Analogue Communications	3
6.452G	Feedback Control I	3
6.457G	Cybernetic Engineering	3
6.472G	Feedback Control II	3
6.481G	Biology and Physiology for Engineers	3
6.659G	Date Bases and Networks	3
6.660G	Programming II	3
6.661G	Business Information Systems	3
6.662G	Computing Practice	3

School of Mechanical and Industrial Engineering

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

Division of Postgraduate Extension Studies* Human Communication

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

		Credits
97.001G	Linguistics and Written and Spoken Communication	2
97.002G	Basic Information Theory	6
97.003G	Human Transinformation	6
97.004G	Psychology of Communication	3
97.005G	Audio and Video Equipment — Capabilities and Applications	4
97.007G	Audio Video Signals in Communication	3
97.008G†	Body in Communication	2
97.010G	Basic Fortran	2
97.012G	Project	5
97.013G	Presentation of Information	3
97.345G	Active and Adaptive Circuits	3
97.346G	Introduction to Microprocessor Systems	2

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

Subjects offered by Tape Correspondence

		Credits
5.075G	Computational Methods in Mechanical Engineering, Part I	2
5.076G	Computational Methods in Mechanical Engineering, Part II	2
6.373G	Semiconductor Devices	3
6.376G	Reliability Engineering	3
6.377G	Integrated Circuit Design	3
6.378G	Solar Energy Conversion	3
6.379G	Solar Cells — Operating Principles, Technology and System Applications	3
6.490G	Using Microprocessors in Real-time Applications	2
8.708G	Finite Element Methods in Civil Engineering	3
97.010G	Basic Fortran	2
97.014G	Thesis	18
97.031G	Linguistics, and Written and Spoken Communication	1
97.032G	Basic Information Theory	1
97.034G	Psychology of Communication	2
97.035G	Audio Video Equipment	2
97.037G	Audio Video Signals in Communication	1
97.038G	Body in Communication	1
97.043G	Presentation of Information	1
97.345G	Active and Adaptive Circuits for Integrated Systems	3
97.346	Introduction to Microprocessor Systems	2

Projects and Research Projects

Supervision of projects and research projects will generally be available in areas of research interest in the Schools of the Faculty. Alternatively, design and other topics may be chosen by arrangement.

Civil Engineering

Engineering Construction and Management

Construction techniques. Equipment selection.
Field studies of spatial layout, material flow, and construction operations.
Micro, macro, and system structure of construction operations.
Civil engineering management.
Critical path methods, and operations research methods in engineering construction.
Information flow requirements and decision processes of office and field agents.

Engineering Materials

Application of finite element techniques to analysis of raft foundations, pile foundations, layered soils, and rigid retaining structures.
Structure — foundation interaction analysis for space frames supported on a raft foundation.
Stabilization of acidic soils.
Deformation and failure of soil under three dimensional stress state (experimental).
Influence of defects on strength and deformation of rocks.
Theoretical and experimental studies of blasting hard rocks.
Foundations subject to dynamic loading.
Influence of admixtures on creep and shrinkage of concrete.
Magnitude and distribution of cracks in reinforced concrete beams.
Analytical and experimental study of fibre reinforced plastics.
Corrosion, fatigue and fracture of metals.

Groundwater

Water movement in unsaturated soils.
Pollutant movement in soils.
Salinity studies.
Groundwater studies.

Hydrology

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

Hydraulics

Two-fluid systems with small density differences.
Sediment motion.
Air entrainment in water in open channels and closed conduits.
Wave action and coastal engineering.
Flow through porous media.
Hydraulic transportation of solids.
Coastal engineering and breakwater stability.

Prestressed Concrete Structures

Partially prestressed concrete beams.
Analysis and design of end blocks for part-tensioned beams prestressed flat plates.

Public Health Engineering

Sewage sludge conditioning and filtration.
Desalination of water.
Clarifiers and sedimentation in water and waste water treatment.
Filtration.
Water-oil separation by flotation and skimming.
Fluidized bed aerobic and anaerobic treatment.
Aerobic digestion.
Nutrient control.

Reinforced Concrete Structures

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

Structural Analysis

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

Transport Engineering

The testing of aggregates.
The properties of pavement materials subjected to repeated loading.
The surface texture of aggregates.
The stability of bituminous mixes.
The testing of full scale pavement systems.
The effects of porosity on the properties of rocks and road making aggregates.
Investigations of the geometric shape of the road alignment on the driver's view of the road.
Study of road alignment design in three dimensions.
Problems of land use and transport interaction.
Theories of traffic structure and flow.
Measurements, planning and control of traffic.
Transport systems analysis.
Investigation of human factors.
Economic evaluation of transport investments.
Transport planning — urban systems.
Investigations into transport economics and policy.
Design of information systems.

Water Resources Engineering

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

Electrical Engineering and Computer Science

Communications

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

Systems and Control

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

Solid State Electronics

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

Mechanical and Industrial Engineering

Electric Power

The stability, dynamics and control of electric power systems.
Instrumentation and protection in power systems.
Power system security and on-line security analysis.
Data acquisition and transmission and switching control.
Applications of field theory.
Electrical measurements.
High voltage and heavy current phenomena.
Electrical discharges and their uses.
Insulation research including partial discharges.
Superconductivity.
Electrical machines and thyristor control schemes.
Special Electrical machines.
Power electronics.
Electric vehicles.
Special Electrical machines.
Power electronics.
Electric vehicles.

Agricultural Engineering

Mechanical harvesting of fruit and vegetables.
Mechanical handling, grading and processing of agricultural produce.
Development of shearing equipment.
Metering and placement of seed and fertilizer.

Applied Mechanics

Biomechanics.
Mechanics of solids, stress analysis.
Impact mechanics.
Adaptive control systems.
Process stimulation and control.
Spatial mechanisms.
Dynamics of machines.
Multi-mode vibrations.
Lubrication and wear.
Computer aided design.
Plastic deformation.

Computer Science

Extensible Computer systems.
Real time incremental computing systems.
Observable computer systems.
Algorithms for industrial scheduling.
Artificial intelligence.
Digital systems description, specification and design.
Commercial software engineering.
Operating systems.
Microprocessor development systems.
VLS1 Systems

Fluid Mechanics/Thermodynamics — including Aeronautical Engineering and Naval Architecture

Two-phase flow with and without hear transfer. Slurries.
Hydraulic transients.
Hydrodynamics, water hammer. Fluidics.
Conduction, convection and radiation. Natural convection.
Refrigeration and air conditioning.
Energy conversion and conservation.
Solar energy and systems.
Engine performance and emissions.

Gas dynamics. Transonic flow. Shock waves.
Jets, turbulent mixing. Noise.
Light aircraft design and performance.
Development of a ship structure optimization system.
Analysis and design of plated grillages.
Vortex shedding in aeronautical and maritime engineering.
Economic studies relative to ship industry.
Hydrodynamics of planing surfaces.

Industrial Engineering — Including Operations Research and Production Engineering

Engineering economic analysis.
Efficiency of production lines.
Optimum shearing policies for rolled bars.
Application of probability theory in the allocation of engineering tolerance.
Computer generation of timetables.
Job shop scheduling.
Least-cost tolerance.
Optimum reject allowance.
Operational simulation.
Variety reduction.
Probabilistic networks.
Optimization techniques relevant to information processing systems.
Statistical decision theory.
Production scheduling for variable demand.
Inventory and production control.
Optimum control.
Mathematical programming.
Dynamic programming.
Geometric programming.
Integer programming.
Large scale optimization.
Applications of operations research to real-world problems.
Stochastic processes.
Applications of optimization techniques.
Experimental and theoretical investigations of the following processes: machining, extrusion, identation, compression, rolling, drawing.
Performance of single and multipoint cutting tools including tool life and economics of machining.
Properties of materials at high rates of strain.
Materials handling studies.
Factory design and location studies.
Plant layout by computer.
Ergonomics.
Social psychology in industry.
Production design studies.
Engineering design analysis and tolerance technology.
Metrology studies.
Group technology studies.

Nuclear Engineering

Neutron transport and diffusion theory.
Thermal and thermo-mechanical analysis of reactor components.
Nuclear reactor noise theory and analysis.
Reactor channel hydrodynamics.
Boiling and two-phase flow.
Nuclear reactor dynamics, stability and control.
Numerical methods for reactor analysis and simulation.
Nuclear power planning and reactor strategy.
Optimization and optimal control in nuclear engineering.
Structural mechanics in reactor technology.
Laser-plasma interaction.
Risk assessment.

Surveying

Geodesy

Physical geodesy, geoid and gravimetric studies.
Satellite geodesy, precise orbit determinations, crustal motion studies using satellite laser ranging data and terrestrial techniques.
Geodynamics: applications of lunar laser ranging and very long baseline interferometry, effects of mass movements on polar motion.
Satellite altimetry analysis, sea surface topography, unification of vertical datums.
Geometric geodesy and geodetic surveying, Doppler positioning determination methods, geodetic astronomy.
Effects of atmosphere on distance, angular and levelling measurements, applications of micro-meteorology.
Adjustments and error theory: applications in geodesy and photogrammetry.
Solution of large systems of equations.
Adjustment of continental control networks.

Photogrammetry and Land Studies

Production and evaluation of orthophotos and other map products.
Cartographic enhancement of orthophoto maps.
Monocular and stereoscopic pointing to photographic images, applications to ground targets, instrument cursors, cartographic symbolization.
Geometry of image sensors, remote-sensing imaging devices, mapping from panoramic photographs.
Non-topographic applications.
Restoration of digital image data.
Accuracy limitations of analogue stereoplotters.
Aerotriangulation, computer applications, block adjustment, independent model triangulation.
Digital terrain models.
Land tenure, registration and survey systems.
Integrated survey systems.
Land data banks, spatial information systems.
Land development.
Residential value models, mass valuation techniques, remote sensing techniques.

Surveying

Deformation and settlement of structures.
Industrial applications of surveying.
Electronic distance measurements: high precision applications, calibrations.
Gyrotheodolite theory and applications.
Development of instrumentation.
Modern optical instrument testing.
Computation systems for desk top computers.

Biomedical Engineering

Modelling of respiratory function, cardiac function, nervous system, artificial kidney therapy, extracorporeal heart-lung support, endocrine system and other body systems.
Microprocessor control of medical equipment.
Limb and joint dynamics studies.
Development of implantable electrodes.
Development of rehabilitation devices.
Statistical analysis of patient therapy and modes of patient treatment.
Development and evaluation of new hospital equipment and treatment procedures.
Signal analyses of wave forms from medical diagnostic equipment.
Implants for fracture support and joint replacement.
Improved drug administration.

Graduate Study

Conditions for the Award of Higher Degrees

First Degrees

Rules, regulations and conditions for the award of first degrees are set out in the appropriate Faculty Handbooks.

For the list of undergraduate courses and degrees offered see **Disciplines of the University: Faculty Table (Undergraduate Study)** in the Calendar.

Higher Degrees

The following is the list of higher degrees and graduate diplomas of the University, together with the publication in which the conditions for the award appear.

For the list of graduate degrees by research and course work, arranged in faculty order, see **Disciplines of the University: Table of Courses (by faculty): Graduate Study** in the Calendar.

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

Higher Degrees

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine	MD	Calendar Medicine
Doctor of Philosophy	**PhD**	Calendar and **all handbooks**
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies

Title	Abbreviation	Calendar/Handbook
Master of Arts	MA(Hons)	Arts
		Military Studies
	MA	Arts
		Military Studies
Master of Biomedical Engineering	**MBiomedE**	**Engineering**
Master of Building	MBuild	Architecture
Master of the Built Environment	MBEnv	Architecture
Master of the Built Environment (Building Conservation)		
Master of Business Administration	MBA	AGSM
Master of Chemistry	MChem	Sciences*
Master of Commerce (Honours)	MCom(Hons)	Commerce
Master of Commerce	MCom	Commerce
Master of Education	MEd	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	**ME**	Applied Science
Master of Engineering *without supervision*		**Engineering**
		Military Studies
Master of Engineering Science	**MEngSc**	**Engineering**
		Military Studies
Master of General Studies	MGenStud	General Studies
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Calendar†
Master of Health Planning	MHP	Professional Studies
Master of Landscape Architecture	MLArch	Architecture
Master of Laws by Research	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Mathematics	MMath	Sciences*
Master of Optometry	MOptom	Sciences*
Master of Paediatrics	MPaed	Medicine
Master of Physics	MPhys	Sciences*
Master of Psychology	MPsychol	Sciences‡
Master of Public Administration	MPA	AGSM
Master of Science	**MSc**	Applied Science
Master of Science *without supervision*		Architecture
		Engineering
		Medicine
		Military Studies
		Sciences*‡
Master of Science (Acoustics)	MSc(Acoustics)	Architecture
Master of Science and Society	MScSoc	Sciences*
Master of Science (Biotechnology)	MSc(Biotech)	Sciences‡
Master of Science (Building)	MSc(Building)	Architecture
Master of Social Work	MSW	Professional Studies
Master of Statistics	MStats	Sciences*
Master of Surgery	MS	Medicine
Master of Surveying	**MSurv**	**Engineering**
Master of Surveying *without supervision*		

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

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

Graduate Diplomas

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:

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

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

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

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

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

Registration

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

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

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

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

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

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

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

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

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

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

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

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

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

Thesis

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

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

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

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

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

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

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

The abstract shall indicate:

(1) the problem investigated;

(2) the procedures followed;

(3) the general results obtained;

(4) the major conclusions reached;

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

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

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

Entry for Examination

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

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

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

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

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

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

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

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

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

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

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

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

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

Master of Biomedical Engineering (MBiomedE)

1. The degree of Master of Biomedical Engineering may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to an appropriate Bachelor degree in the University of New South Wales or other University or tertiary institution at a standard acceptable to the Committee.

(2) In exceptional cases an applicant may be registered as a candidate for the degree if he submits evidence of such academic and professional attainments as may be approved by the Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by completing a qualifying program as determined by the Committee.

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

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two months before commencement of the session in which the candidate desires to commence.

(2) An approved candidate shall register in one of the following categories:

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

(b) student in part-time attendance at the University.

(3) A candidate for the degree shall be required to undertake such formal courses of study and pass such examinations as may be prescribed by the Committee and shall undertake a specified thesis, the satisfactory completion of which shall be regarded as part of the examination.

(4) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may terminate candidature or take such other action as it considers appropriate.

(5) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of two full-time sessions after registration, or the equivalent in part-time study.

(6) The approval of the Director of the Centre for Biomedical Engineering must be obtained by the candidate prior to enrolment.

(7) The program of advanced study, including the preparation of a thesis, shall normally total 60 credits. The number of credits allocated to each subject shall be determined by the Committee on the recommendation of the Director of the Centre. Students with advanced standing may be given limited exemption by the Committee on the recommendation of the Director of the Centre.

(8) The thesis will normally carry 18 credits weighting except in special cases, approved by the Director of the Centre, where a more detailed thesis may carry a weighting of 30 credits towards the award of the degree.

Thesis

4. (1) The project forming the basis of the thesis shall be conducted under a supervisor(s) approved by the Committee on the recommendaiton of the Director of the Centre for Biomedical Engineering.

(2) Every candidate who submits a thesis as provided in paragraph **3.** (3) shall submit three copies in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may also submit any work he has published whether or not such work is related to the thesis.

(3) For each candidate who submits a thesis as provided in paragraph **3.** (3) there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall be an external examiner.

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

Recommendation for Admission to Degree

5. Having considered the examiners' reports and the candidate's other results in the prescribed course of study, the Committee shall recommend whether the candidate may be admitted to the degree.

Fees

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

Master of Engineering (ME)

1. The degree of Master of Engineering may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an investigation, or design or engineering development, which in each case is original.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved University, in an appropriate school.

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

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

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case, before permitting an applicant to register as a candidate, the Committee shall be satisfied that adequate supervision* and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(c) student working externally to the University

(4) Every candidate for the degree shall be required to carry out a program of advanced study to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine. At least once a year and at any other time that the Committee sees fit, the candidate's supervisor shall present to the head of the school in which the candidate is registered, a report on the progress of the candidate. The Committee shall review the report and as a result of its review may cancel registration or take such other action as it considers appropriate.

(5) No candidate shall be considered for the award of the degree until the lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may, with the approval of the Committee be reduced by up to two sessions.

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work he has published whether or not such work is related to the thesis.

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

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

Recommendation for Admission to Degree

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

Fees

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

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

Master of Engineering Science (MEngSc) and Master of Surveying Science (MSurvSc)

1. The degrees of Master of Engineering Science and Master of Surveying Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor with Honours in the University of New South Wales or other approved university or tertiary education institution of acceptable standing in an appropriate school or department.

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

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

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

Registration

3. (1) An application to register for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two full calendar months before the commencement of the course.

(2) An approved candidate shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(3) A candidate for the degree shall

(a) complete a program of advanced study which may include the submission of a report on a project based upon a design or a critical review; or

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

(c) complete an approved combination of the above.

(4) An applicant for registration shall indicate the proposed project area or major field of study in order that the responsibility for the supervision of the program may be determined.

(5) The approval of the appropriate Head of School for the proposed program must be obtained by the candidate prior to enrolment. For the purpose of this regulation the Head of School will normally be the Head of the School providing supervision of the project or research or if there is no project the major field of study. Should the appropriate school be the School of Surveying the degree awarded will be Master of Surveying Science.

(6) The program of advanced study including the preparation of a thesis or report on a project to be completed by each candidate shall total a minimum of 36 credits, the number of credits allocated for each subject being determined by the Committee on the recommendation of Heads of Schools. Where the formal course work comprises no more than 50% of the total study, the candidate will be required to submit a research thesis and where the formal work comprises 50% or more but less than 100% the candidate will be required to submit a report on a project. With the approval of the Head of School, candidates may take subjects from other Schools of the Faculty, other Faculties of the University and other universities or institutions.

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

(8) No full-time candidate shall be considered for the award of the degree until the lapse of two sessions from the date from which registration becomes effective. No part-time candidate shall be considered for the award of the degree until the lapse of four sessions from the date from which registration becomes effective.

Thesis/Project

4. (1) Every candidate who submits a thesis (18 or more credits) as provided in paragraph **3.** (3) (b) shall submit three copies in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may also submit any work he has published whether or not such work is related to the thesis. The format of the report on a project as provided in paragraph **3.** (3) (a) shall comply with the requirements of the Faculty for the preparation and submission of project reports.

(2) For each candidate who submits a thesis as provided in paragraph **3.** (3) (b) there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of whom shall, if possible, be an external examiner.

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

(4) The report on the project (9 credits) provided in paragraph **3.** (3) (a) shall be under the supervision of a member of the academic staff and shall be examined by two examiners. The satisfactory completion of the project shall be regarded as part of the annual examinations.

Recommendation for Admission to Degree

5. Having considered the examiners' reports and the candidate's other work in the prescribed course of study the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

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

Master of Science (MSc)

1. The degree of Master of Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty or Board of Studies (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved University in an appropriate School or Department.

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

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

Registration

3. (1) An application to register as a candidate for the degree of Master of Science shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

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

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(c) student working externally to the University

(4) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an original investigation or design, to take such examinations and to perform such other work as may be prescribed by the Committee. This work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) At least once a year and at any other time that the Committee sees fit the candidate's supervisor shall present to the Head of School in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and as a result of its review may cancel registration or take such other action as it considers appropriate.

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

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit also for examination any work he has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners, appointed by the Professorial Board on the recommendation of the Committee, one of whom, if possible shall be external to the University.

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

Recommendation for Admission to Degree

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

Fees

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

Master of Science (MSc) Master of Engineering (ME) Master of Surveying (MSurv) *without supervision*

1. Where it is not possible for candidates to register under the normal conditions for the degree of Master of Science, Master of Engineering or Master of Surveying by reason of their location at centres which are distant from University Schools or where effective supervision is not practicable registration may be granted in these categories under the following conditions:

Qualifications

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

Registration

3. (1) An application to register as an external candidate for the degree of Master of Science, Master of Engineering or Master of Surveying without supervision shall be lodged with the Registrar for recommendation by the Head of School and consideration by the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his own interest at an early stage, seek the advice of the appropriate School with regard to the adequacy of the subject matter for the degree. A synopsis of the work should be enclosed.

(2) A candidate shall not be considered for the award of the degree until the lapse of six sessions in the case of honours graduates and eight sessions in the case of pass graduates from the date of graduation.

Thesis

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

(b) Every candidate shall submit with the thesis a statutory declaration that the material contained therein is his own work, except where otherwise stated in the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board on the recommendation of the Committee, one of who shall be an internal examiner.

(3) If the thesis reaches the required standard, the candidate shall be required to attend for an oral examination at a time and place nominated by the Committee. The examiners may also arrange at their discretion for the examination of the candidate by written and/or practical examinations on the subject of the thesis and/or subjects related thereto.

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

Recommendation for Admission to Degree

5. Having considered the examiners' reports the Committee shall recommend whether the candidate should be admitted to the degree.

Fees

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

Master of Surveying (MSurv)

1. The degree of Master of Surveying may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to carry out research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) An applicant for registration for the degree shall have been admitted to the degree of Bachelor with Honours in the University of New South Wales or other approved university or tertiary education institution of acceptable standing in an appropriate school or department.

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

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

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

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

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

(3) An approved applicant shall register in one of the following categories:

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

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

(c) student working externally to the University.

(4) Every candidate for the degree shall be required to carry out a program of advanced study, to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) No candidate shall be considered for the award of the degree until a lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may with the approval of the Committee be reduced by up to two sessions.

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work he has published whether or not such work is related to the thesis.

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

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

Recommendation for Admission to Degree

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

Fees

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

Graduate Diploma (GradDip)

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

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

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

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

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

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

5. An approved applicant shall be required to pay the fee for the course in which he desires to register. Fees shall be paid in advance.

Subject Descriptions

Identification of Subjects by Numbers

A subject is defined by the Professorial Board as 'a unit of instruction approved by the University as being a discrete part of the requirements for a course offered by the University'.

Each approved subject of the University is identifiable both by number and by name as this is a check against nomination of subject other than the one intended.

Subject numbers are allocated by the Registrar and the system of allocation is based on the following guidelines:

1. The authority offering the subject, normally a School of the University, is indicated by the number before the decimal point.

2. Each subject number is unique and is not used for more than one subject title.

3. Subject numbers which have not been used for some time are not used for new subject titles.

4. Graduate subjects are indicated by a suffix 'G' to a number with three digits after the decimal point. In other subjects three or four digits are used after the decimal point.

Subjects taught are listed in full in the handbook of the faculty or board of studies responsible for the particular course within which the subjects are taken. Subject descriptions are contained in the appropriate section in the handbooks.

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

The **identifying numerical prefixes** for each subject authority are set out below.

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); CR (Credit or Credit units).

HSC Exam Prerequisites

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

Candidates for enrolment who obtained the HSC in previous years or hold other high school matriculation should check with the appropriate School on what matriculation status is required for admission to a subject.

	School, Department etc	Faculty	Page
1	School of Physics*	Science	90
2	School of Chemistry*	Science	91
4	School of Metallurgy*	Applied Science	92
5	**School of Mechanical and Industrial Engineering**	**Engineering**	93
6	**School of Electrical Engineering and Computer Science**	**Engineering**	105
7	School of Mining Engineering	Applied Science	
8	**School of Civil Engineering***	**Engineering**	117
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	133
15	School of Economics*	Commerce	133
16	School of Health Administration	Professional Studies	
17	Biological Sciences	Biological Sciences	
18	**School of Mechanical and Industrial Engineering (Industrial Engineering)**	**Engineering**	133
21	Department of Industrial Arts	Architecture	
23	**School of Nuclear Engineering**	**Engineering**	140
25	School of Applied Geology	Applied Science	
26	Department of General Studies	Board of Studies in General Education	
27	School of Geography*	Applied Science	142
28	School of Marketing	Commerce	
29	**School of Surveying**	**Engineering**	142
30	Department of Organizational Behaviour	Commerce	
31	School of Optometry	Science	
32	**Centre for Biomedical Engineering**	**Engineering**	150
35	School of Building	Architecture	
36	School of Town Planning*	Architecture	151
37	School of Landscape Architecture	Architecture	
38	School of Food Technology	Applied Science	
39	Graduate School of the Built Environment	Architecture	
40	Professorial Board		
41	School of Biochemistry	Biological Sciences	
42	School of Biotechnology*	Biological Sciences	151
43	School of Botany	Biological Sciences	
44	School of Microbiology	Biological Sciences	
45	School of Zoology	Biological Sciences	
48	School of Chemical Engineering and Industrial Chemistry*	Applied Science	152
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 Studies	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	152
71	School of Medicine	Medicine	
72	School of Pathology*	Medicine	152
73	School of Physiology and Pharmacology*	Medicine	152
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	
81	Medicine/Science/Biological Studies	Medicine	
85	Australian Graduate School of Management	AGSM	
90	Faculty of Law	Law	
97	Division of Postgraduate Extension Studies*		152

*Offers subjects for courses outlined in this handbook.

Physics

Undergraduate Study

The School of Physics has introduced the specialized units 1.951, 1.961, 1.971, 1.981, 1.962, 1.972, 1.982 and 1.992 for students in the Faculty of Engineering. The first-year units 1.951, 1.961, 1.971 and 1.981 are *not* available at night. Part-time students will be catered for by the Science Course unit 1.001.

All first year full-time students, including repeat students, should enrol in 1.951, 1.961, 1.971, 1.981 according to their schools. However, *full-time Electrical Engineering* students may substitute 1.011 for 1.961, subject to the approval of the School of Physics.

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

Physics Level I Units

1.001 Physics I — F L3T3

Prerequisites:

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

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

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

A molecular approach to energy transfer, kinetic theory, gas laws and calorimetry. The wave theories of physics, transfer of energy by waves, properties of waves. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarization. Interaction of radiation with matter, photoelectric effect, Compton effect, spectroscopy. Resolution of the wave-particle paradox by means of wave mechanics and the uncertainty principle.

1.011 Higher Physics I — F L3T3

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

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

Vector algebra, kinematics, uniform circular motion, Coriolis acceleration, dynamics of particles, motion in a resistive medium, work and energy, gravitation, rotational motion of rigid bodies about fixed axis, rotational motion about a fixed point, Lagrange and Hamilton equations, harmonic motions, waves in elastic media, sound waves, physical optics, polarization and double refraction.

Electric charge, electric intensity, electric flux, Gauss' law, electric potential, capacity, dielectric materials, electric current and resistance, DC circuits, magnetic field, field due to a current, electromagnetic induction, inductance, magnetic materials, transients, AC circuits, electronics, diode, rectifier circuit, simple power supplies, electronic amplifier systems, single loop feedback systems, signal processing circuits using operational amplifiers.

1.951 Physics I (Mechanical Engineering) — F L2T2

Prerequisites: As for 1.001 Physics I.

A basic course on physics for students in the School of Mechanical Engineering.

Physical properties of solids, liquids and gases: microscopic theory of elasticity, friction, fracture in solids, viscosity in liquids and kinetic theory of gases. Dynamics of solids and fluids: Newton's laws, energy and momentum conservation, rotational mechanics, fluid mechanics. Compressional waves: acoustics. Thermostatic properties of matter: concepts of thermodynamics, thermal properties of liquids and solids. Electric fields and currents: electrostatics, direct-current circuits. Electromagnetism: magnetic forces and fields, electro-magnetic induction. Non-steady electric currents, transients in RC, LR and LC circuits, alternating-current circuits. Optics: geometric optics, optical instruments, interference and diffraction, polarization.

1.961 Physics I (Electrical Engineering) — F L3T3

Prerequisite: As for 1.001 Physics I.

For students in the School of Electrical Engineering.

Electrostatics in vacuum, electrostatics in dielectrics, steady state currents, magnetostatics in vacuum, ferromagnetism, electromagnetic induction, transient currents.

Vectors, motion in one dimension, motion in a plane, particle dynamics, work and energy, the conservation of energy, conservation of linear momentum, collisions, rotational kinematics, rotational dynamics, simple harmonic motion, gravitation.

Temperature, heat and the first law of thermodynamics, kinetic theory of gases.

Waves in elastic media, sound waves, geometrical optics, interference, diffraction, gratings and spectra, polarization.

1.971 Physics I (Surveying) — F L3T3

Prerequisite: As for 1.001 Physics I.

Aims and nature of physics, linear and rotational mechanics, hydrostatics, elasticity, gravitation, temperature, electricity and magnetism, wave motion, optical instruments, interference and diffraction, lasers and atomic clocks. The importance in surveying of precise frequency, time, speed and distance measurements.

1.981 Physics I (Civil Engineering) — S1 L2T3 and S2 L2T1

Prerequisite: As for 1.001 Physics I.

Aims of physics and its relation to civil engineering. Simple harmonic motion and its relation to wave motion. Electrical and magnetic forces, Electromagnetism DC and AC circuits, bridges. Application of waves to physical optics to explain such phenomena as diffraction, interference and polarization. Holography. Acoustic and mechanical waves, attenuation, velocity of propagation. Elastic moduli. Non-destructive testing, instrumentation, techniques and theory. Emphasis on the physics involved in non-destructive testing and the aspects of vibration important to civil engineering.

Physics Level II Units

1.012 Mechanics and Thermal — S1 L4T1

Prerequisites: 1.961 or 1.001 or 1.011. Co-requisite: 10.2111.

Properties of solids and liquids, elasticity, hydrostatics, hydrodynamics, damped and forced vibrations, resonance, coupled systems, normal modes. Fourier analysis, waves, group velocity, reflection and transmission at a boundary.

Kinetic theory, Maxwell velocity distribution, transport coefficients, first and second laws of thermodynamics, thermodynamic functions, simple applications, microscopic approach to thermodynamics, Boltzmann probability.

1.962 Physics of Measurement (Surveying) — S1 L2½T2½

Prerequisite: 1.971.

Resolution, accuracy and sensitivity of instruments. Errors of observation and their treatment. Experimental design. Displacement transducers. Transducers for other mechanical quantitites. Thermometry. Electrical noise. Dynamic response of measuring systems. Servo-systems. Mechanical design of apparatus. Microscopes, telescopes and other optical instruments. Lenses, optical fibres and other optical components. Photometry. Colorimetry. Measurements under adverse ambient conditions. Analogue-to-digital conversion. Digital instruments. Measurements of very large and very small quantities.

1.972 Electromagnetism (Electrical Engineering) — S2 L2T2

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

Electrostatics in vacuum, Electrostatics in Dielectrics, electric currents, magnetostatics in vacuum, magnetic scalar potential, magnetostatics in magnetic media, time varying fields, Maxwell's equations.

1.982 Solid State Physics (Electrical Engineering) — S1 L2T2

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

The concepts of waves and particles, introductory quantum mechanics, atomic structure, optical spectra and atomic structure, structural properties of solids, band theory and its applications, uniform electronic semiconductors in equilibrium, excess carriers in semiconductors.

Chemistry

Undergraduate Study

2.111 Introductory Chemistry — S1 L2T4

Prerequisite: Nil.

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

2.121 Chemistry IA† — S1 or S2 L2T4

Prerequisites:

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

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

†Students who have passed 2.121 may not subsequently enrol in 2.111 or 2.141. Students meeting the 2.121 or 2.141 prerequisite are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 must pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.

2.131 Chemistry IB — S1 or S2 L2T4

Prerequisite: 2.111 or 2.121.

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

2.141 Chemistry IM† — F L2T4

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Science (Chemistry)	*51-100*
or	
4 unit Science (multistrand)	*51-100*
or	
2.111	

The syllabus is an integrated one of 2.121 and 2.131.

2.951 Chemistry IME — S2 L3T3

A treatment of chemistry which illustrates the application of the principles of chemistry to problems of concern to mechanical engineers. Topics: Chemistry of materials, thermochemistry, chemical kinetics and equilibrium, radioactivity and nuclear power, electrochemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. Surface chemistry.

2.981 Chemistry ICE — S1 L3T3 S2 L2

*Prerequisites:**

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

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

Metallurgy

Undergraduate Study

4.913 Materials Science — F L2T1

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

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

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

4.941 Metallurgy for Engineers — F L1

Part of 5.422 Mechanics of Solids II/Materials.

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

*Students may also meet the prerequisites for this subject by taking 2.111 Introductory Chemistry as part of their first year program.
†Students who have passed 2.121 may not subsequently enrol in 2.111 or 2.141. Students meeting the 2.121 or 2.141 prerequisite are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 msut pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.

Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A* — SS L4T2

Prerequisite:

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

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

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

Introduction to Materials Science: The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.0101 Statics — S1 L2T2

Prerequisites: As for 5.010.

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

5.0102 Introduction to Engineering Design — SS L1T1

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

5.020 Engineering B — S2 L4T2

Prerequisite: 5.010.

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

Mechanics of Solids: 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 — S2 L1½ T1½

Prerequisite: 8.170

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

5.030 Engineering C — SS L2T4 or L/T6

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

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

1. *Production Technology*
(Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option.) Description and appraisal of the processes classified as: forming from liquid or solid, material removal, material joining. Machines. Analysis of the primary functions of the machine tools and an appraisal of their limitations. Principles of operation of common machine tools and illustrations of their use.

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

3. *Introduction to Metallurgical Engineering*
(Metallurgy students must take this option.) History and significance of the exploitation of metals. Ores, mineral economics, mineral processing, and metal extraction and processing methods illustrated by reference to the Australian mineral and metal industries. Properties, uses and applications of metallic materials. The role of the metallurgist in industry and in processing and materials research, and in relation to conservation and the environment.

4. *Introduction to Mining Engineering*
(Mining Engineering students must take this option.) Mineral deposits; metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases; development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mining design and operations.

*Students who wish to enrol in this subject in courses other than the full-time courses in Aeronautical Engineering, Civil Engineering, Industrial Engineering, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.

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

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

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

7. *Introduction to Ceramic Engineering*
(Ceramic Engineering students take this option.) The classification of materials. The nature of ceramics. The materials science approach. The scope of the ceramic industry.

The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials.

Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, pot forming and other forming procedures.

8. *Introduction to Textile Technology*
(Textile Technology students take this option) Introduction to computation in chemical technology; process flow diagrams, information flow diagrams, flow charts in computer programming, development 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 of laboratory and plant data.

5.0301 Engineering Drawing — SS LT/3

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.

5.032 Experimental Engineering II — F L1T1

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

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

5.033 Experimental Engineering III — F L1T½

Prerequisites: 5.032. Co- or prerequisite: 5.071.

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

5.034 Engineering Experimentation — F L½T1

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

Report writing. Experimental method. Scientific method. Engineering method. Errors in experiments. Transducers. Analogue and digital instrumentation systems. Output devices. Static and dynamic instrument calibration. Dynamic signal measurement. Eleven experiments and demonstrations.

5.042 Industrial Experience — LOTO

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in all BSc(Eng) courses. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

5.043 Industrial Training I — SS LOTO

Practical work in industry at the process or shop floor level to gain experience of people, industrial problems and relations, and process equipment. (Report submitted in Week 1 of session detailing involvement and experience gained prior to Year 3).

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

5.044 Industrial Training II — SS LOTO

Practical work in industry at the professional level to gain experience in design, development, investigation or management control systems areas in collaboration with professional engineers. (Report submitted in Week 1 of session detailing responsibilities and experience gained in vacation period between years 3 and 4.)

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

5.051 Thesis — F LOT6

To be taken in year of completion of course.

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

5.061 Technical Orientation — S1 L2TO

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

5.062 Communications — F L2TO

Development of skill in the use of the various media of communication. Effective interpersonal and mass communication using visual and oral transmission. Dynamics and performance of groups. Organizing and directing conferences. Chairmanship. Professional ethics and etiquette.

5.071 Engineering Analysis F L2½T1

Prerequisite: 10.022.

Digital Computer Programming: Numerical Methods: Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations — series and stepwise methods. Solution of partial differential equations — finite difference and iterative methods. Emphasis to be placed on the use of digital computers. *Statistics:* An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of X^2, t and F. Estimation by moments and maximum likelihood: confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction of linear regression.

5.072 Statistics/Computing S1 L1½T½ S2 L2T1

Prerequisites: 10.001 or 10.011.

Statistics: An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of X^2, t and F. Estimation by moments and maximum likelihood: confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression.

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

5.073 Numerical Analysis/ Mathematics F L2T1

Prerequisite: 10.022.

Numerical methods for solution of non-linear equations, linear and non-linear systems, ordinary and partial differential equations. Complex variable theory: differentiation, contour integrals; Laplace and Fourier transforms. Variational methods: optimality conditions; functionals; Euler Lagrange equations; transversality and boundary conditions; one dimensional search; introduction to non-linear programming.

5.074 Computing Science for Mechanical Engineers S1 L2T1

Prerequisite: Computing strand of 5.072.

Hardware and software: Peripheral devices and communications equipment. Program documentation, debugging and testing. Improved programming techniques. Text editors, preprocessors and debugging systems. Computer graphics. Data acquisition. Programming languages.

5.111 Mechanical Engineering Design I F L1T2

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

Application of design strategy to creative design projects. Modelling, analysis and design of basic engineering elements and systems with further engineering drawing practice. Review of currently available mechanical technology and use of standard equipment items, codes and trade literature.

5.112 Mechanical Engineering Design II F L1T2

Prerequisite: 5.111. Co- or prerequisite: 5.412.

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

5.113 Mechanical Engineering Design III F L1½T4½

Prerequisite: 5.112.

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

5.121 Mechanical Engineering Design I S1 L4T4 S2L3

Prerequisites:

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

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

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

Design for Manufacture: The implementation of design and its interaction with manufacturing processes. Manufacturing capabilities and tolerancing. Selection of materials and processes. Approximately 60 hours of practical training, including casting, welding fitting and machining. Project involving appraisal of an existing design and a report recommending design improvements, materials, equipment items and processes to be utilized.

Introduction to Materials Science: The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.122 Mechanical Engineering Design II F L1T2

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

Application of design strategy to creative design projects. Modelling, analysis and design of basic engineering elements and systems with

further engineering drawing practice. Review of current available mechanical technology and use of standard equipment items, codes and trade literature.

5.123 Mechanical Engineering Design III — S1 L2T1 S2 L1T2

Prerequisite: 5.122. Co-requisite: 5.423 or 5.412.

Mathematical modelling and decision making in design with applications. More advanced design analyses, component design and drawing with individual and group projects of an interdisciplinary nature.

5.124 Mechanical Engineering Design IV

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

5.1241 Creative Design Project — SS L0T3

Prerequisite: 5.123.

This subject is concerned with the development of a feasible solution to a specified problem. The execution of the project requires attention to problem identification, creative thinking, feasibility analysis and decision making.

5.1242 Design Technology — SS L1½T1½

Prerequisite: 5.123.

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

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

5.1243 Machinery Design Project — SS L0T3

Prerequisite: 5.123.

Development of the final design for a solution to a specified problem. Requires attention to design analysis, component selection, decision making, specification and the preparation of engineering drawings.

5.1244 Design Management — SS L1½T1½

Prerequisite: 5.123.

Aspects of design management which are necessary for the successful achievement of design objectives. Includes project scheduling and control, contracts, specifications, use of standards and codes, statutory controls, quality assurance, product liability, patent law, marketing.

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

5.1245 Computer Based Engineering Design — S2 L2T1

Prerequisites: S1 of 5.123, 5.074, 5.423.

Design environment. Mathematical modelling: objectives and alternatives; constraints; requirements; variables; subsystems and interfaces. Assumptions and intangibles. Simplifications and validation techniques. Application: system response, evaluation of response, optimum solution. Post-solution analysis. Optimization algorithms and computer routines.

5.303 Mechanical Vibrations — S1 L1T½

Prerequisites: 5.311 or 5.330, 10.022.

Periodic motion, Fourier analysis, simple harmonic motion. Laplace Transform and phasor methods. Single degree-of-freedom system (free and forced vibrations.) Some vibration-measuring instruments. Vibration insolation.

Multi-degree-of-freedom systems. Systems with negligible damping, Dunkerley's formula. Introduction to beam vibrations.

5.324 Automatic Control Engineering — F L2T1

Prerequisite: 10.002.

Laplace transforms and transfer functions. Mathematical modelling of dynamic engineering systems: block diagram methods; properties of linear elements; linearization; analysis of components and systems. Time response and stability: response of first- and second-order systems; system stability; Routh's criterion. Introduction to analog computing. Root locus method. Frequency response: the Nyquist Criterion; closed loop transient response from the open loop frequency response; Bode diagrams. Control systems: types of control action and their effects on system response; controller selection and tuning; analysis of pneumatic control system components.

5.330 Engineering Dynamics — F L1T1

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

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

5.331 Dynamics of Machine I — F L1½T½

Prerequisites: 5.330, 10.022.

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

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

5.332 Dynamics of Machines II — F L2T1

Prerequisite: 5.331.

Vibration of multiple degree of freedom systems. Dynamic effects in machinery. Kinematic equations of motion of spatial systems. Industrial acoustics. The plane wave equation. Trans-mission effects. Mufflers. The three-dimensional wave equation. Enclosures. Transmission in ducts.

5.333 Dynamics of Machines — S2 L2T1

Prerequisites: 5.330, 10.022.

Kinematics and dynamics of planar mechanisms: methods for the analysis of velocities, accelerations and forces in planar mechanisms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing. *Mechanical vibrations:* one degree of freedom systems, free and forced vibrations. Transmissibility and motion isolation. Whirling of shafts.

5.334 Engineering Dynamics II — SS L2T1

Prerequisite: 5.343.

Inertia effects in machinery: analysis of torsional and translational disturbances set up in machines containing one or more reciprocating masses; means of reducing or eliminating undesirable effects. *Mechanical vibrations:* two degrees of freedom systems; free and forced vibrations; applications; the undamped vibration absorber. Multiple rotor systems; free and forced torsional vibrations. Geared branched systems. Introduction to beam vibrations. Matrix methods.

5.343 Linear Systems Analysis — S1 L2T1

Prerequisites: 5.330, 10.022.

Models of physical systems: differential equations for physical systems including mechanical, electrical, hydraulic, thermal and pneumatic systems; linearization. *System analysis techniques:* solution by Laplace transform method. Transfer functions and block diagrams. *System response:* response of first and second order systems to impulse step, ramp, sinusoidal and periodic inputs; higher order system response; system stability, applications.

5.344 Feedback Control — S1 L2T1

Prerequisite: 5.343.

Root locus method: determination of root loci. Calibration of root loci. Closed loop transfer function determination. *Frequency response:* analytical determination of frequency response. The Nyquist criterion for stability. Closed loop frequency response from the open loop frequency response. Closed loop time response from the open loop frequency response. Gain settings for specified time response. Bode diagrams (logarithmic frequency diagrams). *Control systems:* types of control action and their effects on system response. Properties and applications of continuous control actions. Controller selection and tuning.

5.3541 Engineering Noise I — S1 L2T1

Acoustic plane wave equation, standing waves, energy density, intensity, decibel scales. Transmission between media, absorbing materials. Mufflers. Three dimensional wave equation. Transmission in ducts. Room acoustics.

5.3542 Engineering Noise II — S2 L2T1

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

5.411 Mechanics of Solids II — F L1T1

Prerequisites: 5.010, 5.040.

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

5.412 Mechanics of Solids III — F L1½T½

Prerequisites: 5.411, 8.259, 10.022.

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

5.413 Mechanics of Solids IV — F L2T1

Prerequisite: 5.412.

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

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

Plasticity: Laws of plastic deformation. Residual stress. Limit analysis theorems.

5.421 Mechanics of Solids I — S2 L2T2

Co- or prerequisites: 5.010 or 5.0101.

Stress and strain. Bars under axial loading. Stresses and deformation due to bending. Strain energy. Flexibility and stiffness. Stress and deformation due to torsion. Helical springs.

5.422 Mechanics of Solids II/Materials — F L2T2½

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

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

5.423 Mechanics of Solids III — F L1½T½

Prerequisites: 5.422 or 5.411, 10.022.

Fatigue of biaxial and triaxial systems. Deflections of beams and structures. Statically indeterminate beams and structures. Introduction to

theory of elasticity; stress, strain, torsion. Membrane analogy. Finite element stress analysis. Basic concepts; structural stiffness method; bar, triangular, rectangular and brick finite elements; force and displacement methods; development and use of computer programs.

5.424 General Mechanics of Solids SS L2T1

Prerequisite: 5.423.

Inelastic behaviour of bars, beams, shafts and columns. Thick cylinders and composite cylinders loaded by internal and external pressures; rotating discs; contact stresses. Elementary concepts of fracture mechanics; stress intensity factor; fracture toughness; crack propagation.

5.434 Plates and Shells SS L2T1

Prerequisite: 5.423.

Bending of rectangular and circular plates under normal loading; thermal stresses. Shells; membrane stresses, bending stresses, discontinuities at junction of ends; design of pressure vessels.

5.444 Theory of Elasticity SS L2T1

Prerequisites: 5.423, 5.330, 5.611 or 5.622.

Mathematical foundations; analysis of stress; deformation and strain; equilibrium, motion and flow; fundamental laws of continuum mechanics; linear elasticity; viscoelasticity; applications.

5.454 Theory of Plasticity SS L2T1

Prerequisite: 5.423 or 18.413.

Analysis of stress, strain, strain rate; plastic stress/strain relations with description of experimental verification. Application of plasticity theory to a selection of problems including metal working processes such as extrusion and rolling and metallic friction and wear.

5.464 Structural Instability S1 L1½T½

Prerequisite: 5.423.

Buckling of perfect and imperfect columns; bending and buckling of thin flat plates; local instability and crippling of thin-walled columns. Buckling of monocoque cylinders and curved panels. Stiffened panels. Tension field beams.

5.611 Fluid Mechanics/Thermodynamics I F L2T2

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

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

5.612 Fluid Mechanics/Thermodynamics II F L2½T1

Prerequisites: 5.330, 5.611, 10.022.

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

5.614 Fluid Mechanics III F L2T1

Prerequisite: 5.612.

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

5.615 Thermodynamics III F L2T1

Prerequisite: 5.612.

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

5.622 Fluid Mechanics/Thermodynamics F L2T2

Prerequisites: 10.001 or 10.011; 1.951 or 1.001 or 1.011, 5.010 or 5.0101.

5.6221 Introductory Thermofluids S1 L2T2

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

5.6222 Fluid Mechanics S2 L1T1

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

5.6223 Thermodynamics S2 L1T1

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

5.623 Heat Transfer — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Conduction: steady one and two dimensional; unsteady one dimensional. Radiation: radiation properties; shape factor; compound surfaces. Convection: laminar and turbulent boundary layers and heat transfer; flow in ducts and pipes; natural convection. Design of heat exchangers.

5.624 Refrigeration and Air Conditioning — SS L2T1

Prerequisite: 5.611 or 5.622. Co-requisite: 5.623, 10.022.

Psychrometry and air conditioning calculations, heat load, estimates, vapour compression, absorption and air cycle refrigeration, refrigeration and air conditioning systems and components, cryogenic cycles.

5.633 Turbomachines — SS L2T1

Prerequisites: 5.611 or 5.622, 10.022.

Dimensional analysis and experience charts, cavitation, thermodynamics of a stage, blade element theory of axial machines, thin wing theory, cascade data and design procedures, aerodynamic design of an axial machine, theory of centrifugal machines, design of a centrifugal machine.

5.6341 Viscous Flow Theory — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Review of vector analysis and Cartesian tensors. Kinematics of fluid motion. Reynolds transport theorem. Stress in fluid motion. Cauchy's equation. Constitutive equations. Couple stresses. Dynamics of fluid motion. Navier-Stokes equations. Linear and angular momentum equations. Inviscid motion. Thermodynamics of fluid motion. Energy equation. Energy transfer equation. Dissipation function. Enthalpy and entropy. Crocco's, Bjerkne's and Kelvin's theorems. Turbulent motion. Time smoothing. Time smoothed equations of fluid motion. Vortex transport equation. Creeping flow. Similarity.

5.6342 Lubrication — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022

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

5.643 Thermodynamics and Combustion — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

General thermodynamic relations, ideal and non-ideal gases, statistical thermodynamic derivations of internal energy and entropy, ideal gas mixtures. Combustible fuels, combustion equations, internal energy and enthalpy of reaction, First law analysis of combustion, adiabatic flame temperatures. Second law analysis of combustion, chemical equilibrium, chemical kinetics and rate controlled reactions. Application of chemical equilibrium and reaction rate methods to combustion and emission problems. Deflagration, detonation and diffusion flames, mixing controlled reactions.

5.644 Solar Energy — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022. Co-requisite: 5.623.

Radiation heat transfer, spectral distribution of solar radiation and effect of atmospheric absorption. Solar radiation data, total and diffuse components. Analysis of heat transfer processes in solar collectors. Evaluation of performance. Descriptive treatment of indirect methods of use of solar energy.

5.653 Compressible Flow — S1 L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Part **1.** compulsory for Aeronautical Engineers and forms a component of 5.811 — (7 weeks only).
1. One dimensional steady flow: isentropic channel flow, normal shock waves, supersonic wind tunnels and diffusers, flow visualisation. **2.** Two dimensional steady flow: oblique shock waves, Prandtl-Meyer expansions, nozzles, airfoils. **3.** One dimensional unsteady flow: moving waves, reflections, explosions in ducts, shock tubes; method of characteristics, internal flows, piston and valve effects.

5.654 Hydraulic Transients — SS L2T1

Prerequisites: 5.611 or 5.622, 10.022.

Mass oscillations in surge systems with various types of surge tanks. Stability of surge systems, comparison with experiment. Allievi's theory of water hammer, fast and slow closures, water hammer in pumping systems, circle diagrams.

5.661 Mechanical Engineering III — F L2T1

Prerequisites: 1.961 or equivalent, 10.221A.

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

5.663 Potential Flow Theory — S1 L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Introduction and basic concepts. Kinematics of irrotational flow and equations of continuity for an incompressible fluid. Stream function and use of distributed singularities to generate arbitrary body shapes. Airfoils and hydrofoils. Added mass for simple two dimensional shapes. Plane progressive water waves in both deep water and in water of finite depth.

5.664 Multiphase Flow — SS L2T1

Prerequisite: 5.611 or 5.622, 10.022.

Nature of multiphase flow. Gas-liquid, gas-solid, liquid-solid two phase and two-component flows. Three-phase flows. Vertical and horizontal flows. Flow patterns. Correlations. Pressure drop in two-phase flows. Isothermal flows. Flows with heat transfer. Hydraulic and pneumatic transportation of solid materials in pipelines.

5.800 Aircraft Design I — F L2T1

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

Session 1: As for 5.123.
Session 2: Aircraft types, materials, loads, load factors. The design process. Design of members in tension, compression, bending, torsion; rivetted, welded and bolted joints. Wing lift distribution, stressing, design and drawing of components, fittings.

5.801 Aircraft Design II — F L2T1

Prerequisites: 5.303, 5.412 or 5.423, 5.800 (full-time only), 5.811, 5.822. Co- or prerequisite: 5.812, 5.823, 5.831.

A co-ordinated course of lectures in aerodynamics, structures and operations leading to detailed design, calculation and drawing of an original aircraft configuration.

5.811 Aerodynamics I — F L2T1

Prerequisites: 5.330, 5.611 or 5.622, 10.022.

1. Compressible flow: See Part **1.** of 5.653 (7 weeks only). **2.** Low speed aerodynamics: boundary layers, drag; industrial aerodynamics, wind tunnels, airfoils for wings, cascades, propellers, fans; potential flow for airfoils; Prandtl lifting lines, vortex induced drag. **3.** Flight mechanics: performance; static stability.

5.812 Aerodynamics II — F L2T1

Prerequisites: 5.073, 5.612 or 5.811; 5.303 or 5.331, 5.343.

1. Compressible flow: subsonic, transonic and supersonic two-dimensional flows; viscous boundary layers and heat transfer. **2.** Dynamic stability and control: characteristic solutions for rigid aircraft. **3.** Hypersonic, high enthalpy flows.

5.822 Analysis of Aerospace Structures I — F L1½T½

Prerequisites: 5.330, 5.411 or 5.422, 8.259, 10.022. Co- or prerequisite: 5.412 or 5.423.

Equilibrium of forces: aerospace applications of plane frames and space structures. Beams; shear and bending stress distribution in thin-webbed beams, tapered beams, beams with variable flange areas. Semi-monocoque structures; ribs and bulkheads. Deflection of structures; matrix (force) method. Statically indeterminate structures; beams, trusses and frames. Flexibility method; elastic centre method; moment distribution method. Aircraft materials; dimensionless stress-strain data.

5.823 Analysis of Aerospace Structure II — F L1½T½

Prerequisites: 5.412, 5.423, 5.822.

Structural instability: buckling of perfect and imperfect columns; bending and buckling of thin flat plates; local instability and crippling of thin-walled columns; buckling of monocoque cylinders and curved panels; tension field beams. Stress functions. Shear lag. Warping of thin-walled open and closed section tubes. Torsional buckling. Sandwich construction and analysis. Stresses due to torsion and shear in multicell tubes; methods of successive approximation.

5.831 Aircraft Propulsion — F L1½T½

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

Propulsion systems: history, types, basic thrust, efficiency equations. Propellers, fans: engine cycle thermodynamics, performance, testing. Engine intakes: subsonic, supersonic, ramjets. Gas turbine, piston, engine, design, performance. Rockets. Noise, pollution.

5.901 Introduction to Mathematical Modelling and Decision Making — S1 L2T1

Prerequiite: 5.122 or 5.111.

Models and modelling: types, criteria, parameters, constraints; mathematical formulation and validation of models; fundamentals of solution algorithms; post-solution analysis. Decision making: scales and ratings; subjective decision making; mixed rating comparisons; sensitivity; pitfalls. Introduction to project control. Applications from the marine field.

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

5.902 Ship Management Economics — S2 L1½T0

Engineering Economy portion of 18.021.

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

5.911 Ship Hydrostatics — F L2T½

Prerequisites: 5.010 or 5.0101.

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

5.921 Ship Structures I — F L1½T½

Prerequisites: 5.422 or 5.411, 10.022.

Ship structural loading and response. Bending of the hull girder — deterministic aspects. Statistical prediction of wave loads and hull girder response. Basic concepts in finite element analysis — extended beam theory. Applications of extended beam theory — hull girder analysis. Frame analysis and applications in ship structures. Ultimate strength of beams and frames. Laterally loaded grillages and stiffened panels — elastic and ultimate strength analysis.

5.922 Ship Structures II — F L1½T½

Prerequisites: 5.423 or 5.412, 5.921.

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

5.931 Principles of Ship Design IA — S1 L3T0

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

5.932 Principles of Ship Design IIA — S2 L2T0

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

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

5.933 Principles of Ship Design III — F L2T1

Prerequisite: 5.932.

Theory and technique of ship design. Development of ship's lines. Design criteria and data. Criteria of statutory bodies relating to design. Details of ship's structure. Rudders and steering arrangements. Structural design requirements of classification societies. Ship arrangements and equipment. Specifications. Modern shipbuilding methods and prefabrication. Ship operation economics.

5.934 Ship Design Project — S1 L0T3 S2 L0T4½

Prerequisites: All subjects in Years 1, 2 and 3. Co- or prerequisites: 5.922, 5.933, 5.941.

Design of a vessel to provide characteristics of hull form, preliminary general arrangement, lines plan, hydrostatic curves, investigation of stability and trim, structural profile and midship section, capacity, freeboard, tonnage, floodable length (if applicable), power requirements, propeller design, investigation of vibration, rudder design and final general arrangement.

5.9311 Principles of Ship Design I — S2 L2T1

Development of ships and shipbuilding. Ship structure and lines. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard and tonnage. Ship design.

5.9321 Principles of Ship Design II — S2 L2T1

Prerequisite: 5.9311.

Theory and technique of ship design. Blocking out a ships dimensions. Development of weights. General arrangements, depth, freeboard capacity, stability analysis. Preliminary powering, sectional area curve and lines drawing. Estimating, design for construction, ship economics. Classification rules with scantling development. Midship section drawing. Safety and protection of ships. Rudders, trials, manoeuvring, cargo gear, shipbuilding methods production and control. Computerised costing, modular construction, tendering, production concepts, shipyard management.

Ultimate strength of stiffened panels. Ship structural materials, fatigue, fracture. Geometric stress concentration. Welded connections. Pressure hulls. Ultimate strength of hull girder. Structural optimization methods. Automated and computer aided design.

5.937 Ship Design Project — S1 T3* S2 T4*

Prerequisites: 5.901, 5.911, 5.953.

Each student is required to perform the following design tasks and submit the results: **1.** Rationale, specifications, weights, inboard profile. **2.** Power, capacities, freeboard, trim, stability, stern gear. **3.** Sectional area curve, lines drawing, prelim midship section. **4.** Hydrostatics, floodable length and stability curves. **5.** Powering, propeller, systems-schematic drawing, detailed capacity. **6.** Section modulus calculation, bulkhead, midship section, module concept. **7.** Final weights, capacity drawing, operational data, and evaluation.

5.941 Ship Propulsion and Systems — F L2½T1½

Prerequisites: 5.911, 5.951.

Ship resistance. Problems of modelling, Froude's Method and improvements laboratory tests. Viscous resistance, wave resistance, and other components of drag. Propulsion. Propeller terminology and momentum theory. Experiments. Design and selection of propellers. Cavitation and vibration. Manoeuvring. Theory of shop manoeuvrability. Linearized equations of motion. Determination of coefficients and trials. Rudder design. Marine Engineering systems. Steam, diesel, gas turbines, turbo and diesel electric, nuclear propulsion. Systems for fuel, transmission, electricity, pumps, compressors, purifiers, piping systems and automation.

5.953 Ship Hydrodynamics — S1 L2T1 S2 L1½T½

Prerequisite: 5.330.

1. 5.663 (Potential Flow Theory) in Session 1. **2.** 5.952 (Hydrodynamics) in Session 2. Introduction and elementary methods applied to ship hydrodynamics. Dimensional analysis and experimentation. Motion of a spar buoy and derivation of coefficients in equation of motion. Linearized uncoupled motions of a ship. Non-linear aspects. Coupled heave and pitch motion of a ship. Ocean waves and their properties.

*Design laboratory.

Graduate Study

5.045G Advanced Topic in Mechanical Engineering C2

5.046G Advanced Topic in Mechanical Engineering C2

5.047G Advanced Topic in Mechanical Engineering C2

Subjects which may be offered by a Visiting Professor for graduate credit.

5.073G Ordinary Differential Equations in Mechanical Engineering C3

Solutions and their meaning, integration constants, linearity; special methods of solution; integration factors; variation of parameters; Euler, higher order linear equations; physical origins of ordinary differential equations and linear systems; linearization of engineering problems; stability of engineering systems.

5.075G Computational Methods in Mechanical Engineering I C2

Computer programming and numerical analysis review. Solution of transcendental equations. Systems of equations. Calculus of finite differences. Numerical integration, differentiation. Numerical solution of ordinary differential equations.

5.076G Computational Methods in Mechanical Engineering II C2

Partial differential equations: finite differences and finite elements. Mathematical formulation of physical problems in mechanical engineering and their solution.

5.077G Analogue Computation in Mechanical Engineering I C2

Computing components; basic operations and mode control; programming methods; solutions of linear differential equations; system simulation; generation of functions of dependent and independent variables; approximate differentiation, roots of polynomial equations; transfer function simulation; simulation of non-linearities; scaling of linear and non-linear systems; static and dynamic check procedures; automatic iteration.

5.078G Analogue Computation in Mechanical Engineering II C2

Use of digital logic elements: gates, flip-flops, registers, counters and timers. Analog and logic interface and control facilities. Parameter optimization Run function generation. Two-speed operation.

5.086G Digital Logic Fundamentals for Mechanical Engineers C3

Excluded: 6.021E, 6.631, or equivalent.

Discrete logic elements; assembly design; misoriented design; support devices; microprocessor units.

5.087G Microprocessor Fundamentals for Mechanical Engineers C3

Prerequisite: 5.086G, or equivalent. Excluded: 6.613, 6.0318, 6.432, 6.060G, 6.433G, 6.561G, or equivalent.

Microprocessor chips; system design; memory; past design; programming; applications.

5.088G Industrial Applications of Microprocessors C3

Excluded: 6.432, 6.433G, 6.651G, or equivalent.

Coding and programming. Transducer selection. Information transfer. Data storage. Power output device control. Application to industrial automation and control. Laboratory complement to lectures.

5.151G Refrigeration and Air Conditioning Design I C3

5.152G Refrigeration and Air Conditioning Design II C3

Design of refrigeration equipment: compressors; throttling devices; condensers; evaporators. Cooling towers: evaporative condensers; air conditioning coils. Generators and absorbers for absorption systems. Piping systems. Air ducts. Steam raising and water heating equipment. Calculation of transient heating and cooling loads. Air conditioning systems. Load analysis and system capability.

5.304G Advanced Dynamics I C2

5.305G Advanced Dynamics II C2

Revision of Engineering Mechanics. Velocities and accelerations in three-dimensional co-ordinate systems. Moving frames of reference (vector equations). Eulerian angles. Ellipsoid of inertia. Lagrange's equations (various examples including applications to vibrations). Euler's equations of motion. General motion of tops and gyroscopes — stability. Lagrange's equations for impulsive forces. Hamilton's Principle.

5.315G Mechanisms I C2

5.316G Mechanisms II C2

Selected topics from: Analysis of complex planar mechanisms; synthesis of planar mechanisms; spatial linkages; cams.

5.317G Industrial Robotics C3

Applications survey. System structure, hardware, software, handling. Linkage kinematic structure; power transmission. Linkage structural design. Actuator choice. Interface hardware. Feedback. Function programming philosophies. Control algorithms. Problem specification; solution preparation. Writing, storage, implementation of computer algorithms.

5.321G Automatic Control I C2

Continuous-action controllers: controller selection and tuning; optimum settings; maximum gain method. Control system simulation. Pneumatic systems for control.

5.322G Automatic Control II C2

Analysis of non-linear control system. Describing functions and limit cycle amplitude and frequency determination. Studies of systems in which the following non-linearities dominate the behaviour: backlash, coulomb friction, deadspace, hysteresis and saturation. Analog simultation of non-linear systems. Electronic systems for control. On-off control with and without feedback stabilization. Single-speed floating control, with and without feedback stabilization.

5.328G Control and Modelling of Mechanical Systems I C3

5.329G Control and Modelling of Mechanical Systems II C3

Development of modelling techniques using both digital and analogue computation, with special emphasis on the representation of non-linearities. Typical examples of mechanical systems.

5.335G Vibrations C2

Comparison of time, frequency, transform domain techniques for linear systems analysis. Application of Lagrange's equation and matrix methods in free, forced multi degree-of-freedom systems. Modal analysis; numerical methods. Beam shaft vibrations; approximate methods. Self-excited vibrations, stability. Random vibrations. Laboratory work on vibration measurement, testing.

5.336G Random Vibrations C2

Probability, vibration theory review, linear mechanical system response to random vibrations. Statistical characteristics: auto correlation, spatial density, convolution, narrow band processing, consistency, applications.

5.401G Experimental Stress Analysis C2

Grid technique; Moire fringe method; Strain gauges; photoelasticity; crack detection techniques. Class project.

5.415G Stress Analysis for Mechanical Engineering Design I C3

5.416G Stress Analysis for Mechanical Engineering Design II C3

Three topics in each subject selected from: Pressure vessels and enclosures. Analysis for fatigue. Plastic collapse, limit state design. Analysis of stress concentrations. Plate girder panel structures. Lightweight structures. Analysis of machine frames. High temperature components. Strength of gears. Use of computer packages in stress analysis.

5.417G Mechanics of Fracture and Fatigue C3

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

5.428G Advanced Mechanics of Materials C2

Plasticity. Creep.

5.491G Biomechanics I C2

Statics, dynamics of the musculoskeletal system: mathematical modelling, computer simulation, analysis of walking, working and athletic activities; analysis of pathological situations.

5.492G Biomechanics II C2

The physical properties of materials having significance in biomedical engineering: human tissues, skin, soft tissues, bone; metals. Polymers and ceramics: the effects of degradation and corrosion.

5.601G Computational Fluid Dynamics C2

Prerequisite: 5.076G.

Incompressible flow: primitive equations; stream function, vorticity equations. The conservative property. Stability analysis. Explicit, implicit methods. Upwind differences. SOR methods. Fourier series methods. Pressure, temperature solutions. Solving the primitive equations.

5.616G Internal Combustion Engines I C3

Thermodynamic cycles. Combustion, reaction kinetics. Real engine cycles. Chart, computer analysis. Spark ignition engines. Flame physics. Combustion chamber design. Charging, discharging; heat transfer; friction. Emissions, fuels, computer modelling: efficiency, performance, emissions. Testing, laboratory.

5.617G Internal Combustion Engines II C3

Modifications, alternatives to SI engine: Stratified charge, rotary, orbital, turbo charged, two stroke. Compression ignition engine: combustion knock, chamber design, emissions. Gas turbines. Cycles, limitations, regeneration, combustion, emission. Axial, centrifugal compressors, turbines; matching. Aircraft, automotive, industrial types. Stirling engines: cycle analysis, design laboratory.

5.621G Gasdynamics I C2

5.622G Gasdynamics II C2

Kinematics, dynamics, thermodynamics, vorticity. Nozzle. Wind tunnel. Diffusers. Shock waves; steady, moving. Method of Characteristics. Combustion. Real gas behaviour at high temperature. Hypersonic aerodynamics, free molecule flow, re-entry; high energy experimental methods.

5.631G Lubrication Theory and Design I C2

Hydrostatic lubrication, squeeze films, hydrodynamic lubrication, slider bearings, tilting pad thrust bearings, journal bearings, practical journal and thrust bearing design; air bearings; friction, wear; dry boundary lubrication; lubricant, bearing material selection; anti-friction bearings.

5.632G Lubrication Theory and Design II C2

Continuum equations of hydrodynamic lubrication. Journal bearing dynamics. Rolling contacts. Elastohydrodynamic lubrication. Grease lubrication. Plasto-elastohydrodynamic lubrication. Metal forming, cutting lubrication.

5.653G Acoustic Noise I C2

Acoustic waves, sources. Near, far fields. Vibrating surfaces. Turbulent flows. Transmission in gases, liquids, solids. Boundary reflection, refraction, transmission, scattering. Absorbing materials. Reverberant, anechoic environments, spaces, ducts. Resonators.

5.654G Acoustic Noise II C2

Noise measuring, instrumentation. Random signal analysis. Human response. Noise ratings, indices. Noise criteria. Assessment problems, control, isolation. Vibration control. Acoustic damping materials. Common noise source characteristics.

5.712G Convection Heat Transfer I C2

5.713G Convection Heat Transfer II C2

Fluid Dynamics: boundary layer equations, solutions; transition, turbulence. Pipe flow, surface roughness. Pressure gradients. Isothermal two-phase flow. Forced convection: laminar flow; thermal boundary layers; variable fluid properties; approximate solutions; turbulent flows; high-speed flows; rarefied gases; transpiration, film cooling. Free convection: vertical surfaces, isolated bodies, horizontal surfaces, cavities, heat transfer with change of phase: condensation, evaporation; boiling, burnout; boiling in tubes; two-phase flow with phase changes. Heat exchangers; overall performance estimation.

5.718G Conduction Heat Transfer C2

Steady, one-dimensional conduction. Analysis of extended surfaces. Two- and three-dimensional conduction. Unsteady conduction in one or more dimensions; analytical, numerical and analogical methods of solution. Initial value and boundary value problems. Temperature fields with heat sources. Non-homogeneous bodies; anisotropic bodies; variable material properties.

5.719G Radiation Heat Transfer C2

Thermal radiation properties of materials, black bodies; characteristics of real solids, liquids and gases; radiation exchange between infinite surfaces and between finite surfaces; shape factor for various configurations; radiation in an enclosure; radiation behaviour of gases and vapours. Pyrometry. Solar radiation; solar angles; atmospheric absorptions of solar radiation; direct and diffuse radiation; pyrheliometers.

5.720G Performance, Evaluation and Simulation of Solar Collector Systems C2

Complete solar system analysis; long term performance prediction including weather, land characteristics. System modelling; energy storage; building characteristics; heating and cooling.

5.725G Statistical Thermodynamics C2

Mathematical probability. Classical statistical mechanics. Quantum statistics. Statistical-mechanical ensembles. Ideal monatomic gas. Fermi-Dirac statistics, Fermi-Dirac gas. Ideal Bose-Einstein gas — Black-body radiation. Ideal lattice gas. Ideal diatomic gas. Gas of symmetrical diatomic molecules at low temperatures. Ideal polyatomic gas. Chemical equilibrium in ideal gas mixtures. Lattice statistics. Imperfect gas. Approximate cell and hole theories of the liquid state. The solid phase. Irreversible processes.

5.735G Direct Energy Conversion C2

Magneto-hydrodynamics (M.H.D.): governing equations, ionisation seeding of working gas; material property limitations; fossil, nuclear fuelled M.H.D. generator combined with conventional steam plant. Fuel cells: electro chemical fundamentals; maximum work, Gibbs function, enthalpy of formation, equilibrium constant, e.m.f., limitations, polarization, existing types. Thermoelectric generators: theory of irreversible thermodynamics, Onsager coefficients, coupled phenomena, Peltier, Thomson, Seebeck effects, thermal efficiency, max. power output; deisgn of thermodynamic generator, theremoelectric cooler, magneto-theremoelectricity; radioisotope, solar powered generators; semi-conductors, basic ideas of quantum physics, Fermi level and energy bands. *Other modes of direc 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. Theremodynamics of change of phase; liquids and dilute solutions; mixtures of liquids; steady flow processes with binary mixtures; rectification of a binary mixture; absorption refrigeration; resorption refrigeration. The vapour compression cycle; multi-pressure systems; analysis of compressor performance; condensers, evaporators and expansion devices; properties of the ideal refrigerant; reversed cycles; analysis and performance characteristics of the complete cycle. Air-cycle, steam-jet refrigeration; application to air conditioning design; cooling towers, mixtures of gases and vapours; psychrometry, evaporative cooling of air; dehumidification of air. Thermoelectric cooling; Seebeck, Joulean, conduction, Peltier, Thomson effects; thermodynamic analysis; theremoelectric materials. Production of low temperatures; liquefaction and rectification of gases; magnetic cooling; application to research.

5.758G Refrigeration and Air Conditioning Applications C4

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

5.909G Research Project C9

5.912G Naval Hydrodynamics I C2

5.913G Naval Hydrodynamics II C2

Prerequisite: 5.912G, or equivalent.

Advanced treatment of topics selected from: ship waves and ship resistance; ship manoeuvrability; ship motion and seakeeping; hydrofoil and propeller theory; aero and hydrodynamics of surface effect machines.

5.918G Research Thesis C18

5.936G Research Thesis C36

Electrical Engineering and Computer Science

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, computers and microprocessors; systems and circuit theory; probability, information and communication. Laboratory exercises and project work in these areas include instrumentation and device characteristics.

6.021A Circuit Theory I — S1 or S2 L2T2

Prerequisites: 1.961 or equivalent, 6.010, 10.001.

Lumped modelling concepts used in circuit theory and their relationship to observed physical properties and behaviour. Linear circuit elements. Kirchhoff's Laws. Resistive network topology and systematic derivation of network equations using node and loop methods. Network theorems. Exponentials and first order transients. Sinusoidal steady state operation including phasors, impedance and admittance concepts and systematic circuit equations. Power relations and second order systems response. Resonance, Q factor and bandwidth. Three phase circuits. Controlled sources and two port analysis.

6.021B Power — S1 or S2 L2T2

Prerequisite: 6.021A attempted.

An introduction to the transmission, distribution and utilization of electrical energy, including devices which use the interaction of electric, thermal and magnetic fields. Topics include a revision of three-phase circuit analysis, magnetic circuits, transformers, and basic electro-mechanical energy conversion.

6.021C Electronics I — SS L2T2

Prerequisite: 1.982, 6.021A.

A unified treatment of the fundamental principles of bipolar and field-effect transistors and their operation in simple circuits at low frequencies and room temperature in the static approximation (ie where the frequency and temperature characteristics of the device itself are neglected). Stress on showing how to set up the transistor currents and voltages to give the circuit characteristics desired of the device (ie switching, amplification, high (or low) input impedance, etc.). An introduction to the Operational Amplifier and its uses.

6.021D Computing — S1 or S2 L2T2

Prerequisite: Computing strand of 5.030. Excluded: 6.600, 6.611, 6.620 and 6.621.

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.

6.0311 Circuit Theory II — S1 or S2 L2T2

Prerequisites: 6.021A, 10.111A, 10.1113, 10.1114, 10.2111, 10.2112, (Two of 10.1113, 10.1114, 10.2111 or 10.2112 may be taken as co-requisites), 6.021B, 6.021C (one of 6.021B or 6.021C may be taken as a co-requisite).

Basic circuit concepts followed by basic system ideas such as order, state, linearity and typical system waveforms.

Typical linear time invariant systems modelled and described by differential equations leading to use of Laplace transforms. Partial fractions, poles, zero and stability. Transfer functions and circuit responses both in time and frequency domain. Distributed circuits and transmission lines. Telegraphist's equation. Characteristic impedance and propagation constant. Terminated lines and reflection coefficient. Steady-state frequency response of lines and standing waves. Use of Smith chart. Transients and pulse reflection on lines.

6.0312 Utilization of Electric Energy — S1 or S2 L2T2

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

A continuation of study of the utilization of electrical energy commenced in 6.021B. Topics treated included dc machines, three-phase and single-phase induction machines, induction motor speed control, synchronous machines, power electronics, the thermal behaviour of equipment and the rating of plant.

6.0313 Electronics II — S1 or S2 L2T2

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

Review of basic transistor theory and properties. Design and analysis of small signal amplifiers incorporating bipolar junction transistors and operational amplifiers. Applications of negative feedback. Differential amplifiers. Structure, properties and use of operational amplifiers.

6.0314 Systems and Control I — S1 or S2 L2T2

Prerequisite: 6.0311.

An introductory overview of systems and control, with examples from modern industrial and scientific practice. Dynamic systems modelling. Time and frequency domain relationships. Block diagrams. Feedback theory and sensitivity. Operational amplifier systems. Simulation of systems by analog and digital computers. Stability theory. Nyquist theorem. Routh test. Root locus.

6.0315 Electrical Energy — S2 L2T2

Prerequisite: 6.0312 attempted.

Aspects of the supply, control and use of electrical energy. Distribution of power: electrical and thermal considerations of conductor systems. Thermal rating of electrical equipment. Control and protection of low voltage systems. Circuit breakers, fuses, relays, surge divertors and their application. Electrical methods of industrial heating. Lighting. Power electronics — the use of power solid state devices in the control and use of electrical energy.

6.0316 Electronics III — S1 or S2 L2T2

Prerequisite: 6.0313. Co-requisites: 6.0311, 6.021E.

Extension of 6.0313 to include tuned amplifiers, oscillators, large-signal electronics of bipolar and field-effect transistors, charge-control switching analysis for bi-polar and field-effect transistors, power amplifiers, waveform generators and shapers, monostables, astables, and an introduction to digital electronics, with an increasing emphasis on integrated circuit realizations.

6.0317 Communication Systems I — S2 L2T2

Prerequisite: 6.0311. Co-requisites: 10.361.

Overview of information acquisition, transmission and processing. Aims to enable a student not specializing in this field to qualitatively understand the communication problems he is likely to meet in his career, and a general background if he intends to specialize in communications.

6.0318 Microprocessor Systems and Applications — S1 or S2 L2 T2

Prerequisites: 6.021D or 6.620, 6.021E or 6.631, 6.021C. Excluded: 6.613.

LSI technologies and devices. Microprocessor integrated circuits. Outline of system configurations. Microprocessor busses, control signals and timing. Programming models and instruction sets. Programming elements including addressing modes, arithmetic and I/O. Memory devices including RAM, ROM, EPROM. Input/output devices and support chips. Parallel and serial I/O devices. Direct memory access. Interrupt systems. An introductory description of microcomputer system devices including cassette tape, floppy disk, keyboards, LED and video displays. A structured approach to programming. System development software including monitors, PROM programmers, editors, assemblers and higher level languages. Development tools, logic state analysers, emulators. Laboratory work involving both hardware and programming experience, where typical applications are considered.

6.041 Electrical Measurements — SS L2T3

Prerequisite: 6.0311, 6.0313.

Not offered in 1981.

A course of lectures and laboratory work of one session's duration treating basic electrical measurements using null or deflection techniques with analog or digital presentation in the range from DC to an upper frequency limit where lumped circuit techniques begin to be inadequate.

6.042 Digital and Analogue Signals — S1 L2T3

Prerequisites: 10.033, 10.361.

Analysis and processing of continuous-time and discrete-time (digital) signals: Generalized Fourier analysis; convolution, correlation, energy and power density spectra. Signal distortion (linear and nonlinear) Hilbert transforms; analytic signals, signals in systems. Sampling and digital processing of analogue signals; the discrete Fourier transform (DFT), the fast Fourier transform (FFT), algorithm. Design of finite and infinite impulse response (FIR and IIR) digital filters. Analysis of random signals and noise; transmission through linear systems and nonlinear devices, signal-to-noise ratios, matched filters. Estimation and measurement of power density spectra.

6.044 Electrical Product Design and Reliability — SS L2T3

Prerequisite: 10.361.

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

6.045 Electrical and Electronics Engineering Materials — S2 L3T2

Prerequisite: 6.0313. Excluded: 6.022.

A survey of materials and their technology for electrical and electronic devices and systems. Influence of molecular and crystallographic 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.

6.056 Mechanical Engineering — S2 L/T4

Prerequisites: 1.961 or equivalent, 10.2111, 10.2112.

Systems, reversibility, work and heat. Laws of Thermodynamics for non-flow and flow processes, entropy, process efficiency and availability. Properties of real fluids. Carnot, Rankine, Joule, Otto, Diesel and refrigeration cycles. Conduction, convection and radiation heat transfer. Design of heat sinks for transistors and other solid-state devices, and methods for derating these devices for changes in ambient conditions.

Analysis of real systems; flow in adiabatic ducts, rotary machinery, steam plant, internal combustion engines, refrigeration, direct and unconventional energy conversion (fuel cells, thermoelectric power generation).

6.202 Power Engineering—Systems I — SS L2T3

Prerequisites: 6.0312, 6.0315.

An elective emphasizing parameters and performance of power system components; transmission lines and cables, transformers, synchronous machines; power system overvoltages; fault calculations; circuit interruption; protection; distribution systems.

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; energy resources.

6.212 Power Engineering—Utilization SS L2T3

Prerequisites: 6.0312, 6.0315.

Topics include: Machines and electrical drives, applications and control, in particular using power reftifiers and thyristors; industrial heating; frequency changing; illumination. A program of experimental projects and design applications will accompany the lectures.

6.222 High Voltage and High Current Technology LS L2T3

Prerequisite: 6.0315.

An elective concerned with aspects of design and testing of electrical equipment used in the power industry. Topics include: fields and materials as applied to high power apparatus; effects of high currents; design of testing equipment; methods of measurement of hv and hc under steady state and surge conditions; effects of transients; earthing techniques.

6.303 High Frequency Circuits and Electronics I S1 L2T3

Prerequisites: 6.0311, 6.0316, 6.0317.

Fundamental aspects of high frequency and microwave circuits and electronics: TEM transmission lines, with emphasis on coaxial and microstrip lines and components. Introductory antenna theory, phased arrays and wide-band antennas. Two-port characterization, scattering parameters and noise theory, with application to high frequency bipolar and field effect transistors.

6.313 High Frequency Circuits and Electronics II S2 L2T3

Prerequisite: 6.303.

The material extends 6.303 High Frequency Circuits and Electronics I into further areas of high frequency and microwave circuits and electronics: Plane wave propagation and application to terrestial communications. Waveguide theory and aperture antennas. Parametric amplifiers. Microwave sources, with emphasis on Gunn and impatt diodes.

6.322 Electronics IV S1 or S2 L2T3

Prerequisites: 6.0313, 6.0316.

Theory and applications of some electronic devices and systems with an associated laboratory-design program. Analogue or digital integrated circuits introduced as appropriate. Topics may include: active filters, switched transistor application, phase locked loops, optical links, charge coupled devices, power electronics, design factors of large electronic systems.

6.323 Communication Systems IIA S1 L2T3

Prerequisites: 6.0317, 10.033, 10.361.

Theory and practice of modern analogue and digital telecommunications techniques, including computer communications. Topics include: linear and nonlinear analogue modulation (AM, SSB, FM, etc) digital signal transmission, pulse code modulation, multiplexing (FDM and TDM), computer communication, error control, synchronization, relay systems, transmitters and receivers, aspects of transmission media relevant to telecommunications systems.

6.333 Communication Systems IIB S1 L2T3

Prerequisites: 6.0316, 6.0317.

The material of 6.0317 is extended and applied to communications systems other than telecommunications systems. Topics covered are radio and sound systems (AM and FM, psychoacoustics, electroacoustics), television (colour vision, teletext, etc), radar and sonar, navigation systems.

6.412 Systems and Control II S1 L2T3

Prerequisites: 6.0311, 6.0314.

The design and analysis and identification of single and multivariable feedback control systems as encountered in industrial processes. Emphasis on the synthesis of a prescribed dynamic performance via both transient and frequency domain methods. Consideration of the effects of nonlinearities on the system performance. Simulation and computer-aided design.

6.413 Digital Control S2 L2T3

Prerequisite: 6.412.

The design and analysis of digital control systems. Consideration of problems in analog-digital and digital-analog conversion such as quantization, aliasing and finite word length and their relation to the design of numerical control algorithms. On-line digital identification and adaptive control techniques as illustrated by the self-tuning regulator, minimum variance and dead beat control structures.

6.432 Computer Control and Instrumentation SS L2T3

Prerequisites: 6.021D, 6.021E, 6.0314, 6.0316.

Current practice in hardware and introduction to software techniques as applied to the implementation of control and instrumentation systems. Analog computers and associated circuit techniques. Transducers, actuators, controllers and special electro-mechanical devices discussed from both physical and dynamic response viewpoint. Digital instrumentation and displays. Hybrid devices and analog conversion. Sampling. Computer organization and interfacing concepts. Microprocessors. Peripherals. Introduction to software systems for control applications. Computer control of processes via on-line languages.

6.483 Biomedical Engineering SS L2T3

Prerequisites: 6.0311, 6.0313, 6.0314, 6.0316.

A course designed to introduce electrical engineering students to the practice of engineering techniques applied to the biological and medical fields. The lectures are supplemented by demonstrations and experimental work, and deal with the basic physiology of cells, tissues, organs and organisms, instrumentation and measurement techniques and modelling of various types of biological systems.

6.512 Advanced Semiconductor Device Theory — SS L2T3

Prerequisite: 6.0313.

Principles of operation and circuit characteristics of a range of semiconductor devices including bipolar diodes and transistors, MOS devices and circuits, charge-coupled devices, solar cells, light-emitting diodes, and semiconductor lasers. The lectures are supplemented by experimental work with these devices.

6.522 Transistor and Integrated Circuit Design — SS L2T3

Prerequisites: 6.0313, 6.0316.

Analysis of bipolar and field-effect transistor structure and operation as far as necessary for the development of accurate models for use in computer aided circuit design. Ebers Moll (EM) and Gummel-Poon transistor models. Aspects of the solution techniques used in modern CAD programs such as SPICE. Integrated circuit design including special circuit and layout considerations to take advantage of the inherent component matching. Consideration of selected circuits, for example, high-performance operational and instrumentation amplifiers, multipliers and other non-linear circuits, voltage controlled oscillators, A/D and D/A converters, etc, as class interests suggests. Practical work centres around use of the VAX11-780 computing and colour graphic CAD facilities of the Integrated Circuit Laboratory.

6.606 Computing Science Honours

6.607A Computing Hardware Architecture — S1 L3T2

Prerequisites: 6.613, 6.632, 6.642, 6.643 at an acceptable level.

The basic principles of computer architecture. A comparative study of the architectural features of a number of significant computer systems.

6.607B Advanced Software Technology — S2 L3T2

Prerequisites: 6.613, 6.632, 6.642, 6.643 at an acceptable level.

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

6.611 Computing I — S2 L3 T3

Prerequisite: As for 10.001. Co-requisite: 10.001 or 10.011. Excluded: 6.600, 6.620, 6.021D.

Introduction to programming: design and correctness of algorithms and data structures; programming in a high level algorithmic language which provides simple, high level program control and data structuring facilities. Problem solving: basic ideas of problem solving; introduction to abstract structures used for computing solutions to problems. Elementary logic, history of computing, computing machinery.

6.612 Computer Systems Engineering — SS L2T3

Prerequisites: 6.021E or 6.631.

Use of hardware descriptive languages for digital system design and simulation language. Applications to the description, design and simulation of basic computer circuits and organizations. Machine organization and hardware, control units, micro programming, input-output, high-speed arithmetic units.

6.613 Computer Organization and Design — SS L2T3

Prerequisites: 6.631 or 6.021E, 6.021D or 6.620 or 6.621. Excluded: 6.0318.

Translation of high-level language code to machine assembly language code; processes, synchronization and communication. Bussing structures (asynchronous and synchronous); parallel and serial device and processor communication and interfacing; input/output organization: polling, interrupt and DMA control. Device and memory organization. Microprocessor case studies. Operating system I/O kernel, device drivers. Practical work is undertaken in a microprocessor, visual development laboratory.

6.620 Introduction to Computer Science — S1 or S2 L3T2

Prerequisite: 10.001. Excluded: 6.600, 6.021D, 1.041, 6.611, 6.621.

Not available in full-time course after 1981.

For those students who intend to take further subjects in computing science. Introduction to programming: design and correctness of algorithms and data structures: programming in a high-level algorithmic language which provides simple, high-level program control and data structuring facilities. Introduction to computer organization: simple machine architecture. Introduction to dynamic data structures, elementary logic. Introduction to operating systems and computing machinery.

6.621 Computing II — S1 L3T2

Prerequisites: 6.611, 10.001 or 10.011. Excluded: 6.620, 6.021D.

Not available until 1982.

For those students who intend to take further subjects in computer science.

Expansion and development of material introduced in 6.611. Systematic program development: introduction to programming language semantics, reasoning about programs, program derivation, abstract programs, realization of abstract programs (conversion from abstract to concrete). Practice in programming in a high-level programming language. Data-structures: arrays, lists, sets, trees; recursive programming. Introduction to computer organization: a simple machine architecture. Introduction to operating systems.

6.622 Computing Application and Software — SS L2T3

Prerequisites: 6.620 or 6.600 (C) or 6.021D.

The use of computers for solving problems with a substantial mathematical and operational research content: includes use of some standard software packages. Topics selected from: discrete event simulation; the SIMULA programming language; psuedo random number generation; simple queuing theory; applications of mathematical programming; statistical calculations; critical path methods; computer graphics; artificial intelligence.

6.631 Assembler Programming and Digital Logic — S1 or S2 L3T2

Prerequisites: 6.620 or 6.621 or 6.600 (C) or 6.021D. Excluded: 6.021E.

Assembler programming: programming in a low level machine oriented language in order to illustrate the mapping of higher level language constructs onto a typical machine and the interaction between operating systems and devices. Digital logic design: register transfer description of

a tutorial computer, switching algebra, minimization, combinational logic design, integrated circuits, registers, counters, and other medium scale integration (m.s.i.) devices, clocked sequential circuits, computer arithmetic.

6.632 Operating Systems — S1 L3T2

Prerequisites: 6.631 or 6.021E, 6.641.

Introduction to operating systems via an intensive case study of a particular system, namely the UNIX Time-sharing system which runs on the PDP11 computer. Includes system initialization, memory management, process management, handling of interrupts, basic input/output and file systems. A comparison of UNIX with other operating systems. General principles for operating system design.

6.633 Data Bases and Networks — S2 L3T2

Prerequisite: 6.641. Excluded: 14.602, 14.603, 14.604, 14.605.

Data management: compression techniques; redundancy coding; indexing; hashing; encryption and decyrption. Data base management systems: data description languages; data manipulation languages; integrity and recovery. The relational view of data. Computer networks: digital data transmission; communication protocols; circuit switching; packet switching; packet routing; network performance. Current international standards and practice. Distributed data bases.

6.641 Programming I — S1 or S2 L3T2

Prerequisite: 6.620 or 6.600 (C) or 6.021D or 6.621.

Design and correctness of algorithms and data structures. Data structures: abstraction, representation, manipulation and axiomatization; basic data structures: sets, unions (variant records); dynamic data structures, lists, queues, stacks, trees, balanced trees. Recursion: backtracking algorithms. Files: sequential access, random access, merging, sorting, updating. String manipulation, pattern matching and associative algorithms.

6.642 Programming II — S1 L3T2

Prerequisite: 6.641.

Development and analysis of algorithms and data structures. Models of computation: uniform and logarithmic cost, decision trees. Design of efficient algorithms: divide and conquer, recurrence equations, balancing, dynamic programming. Analysis of algorithms: worst and expected case order statistics. Set manipulation problems. Key transformations (hashing). Trees: optimal, balanced, multiway. Graphs. Finite state recognition: regular expressions, pattern matching algorithms. Computability. NP-complete problems.

6.643 Compiling Techniques and Programming Languages — S2 L3T2

Prerequisite: 6.641.

1. Language description: phrase structure grammars, Chromsky classifications, context-free grammars, finite state grammars, Backus Naur Form, syntax graphs, LL(k), LR(k), SLR(k), LAL(k), simple-precedence and weak-precedence grammars. **2.** Lexical analysis: translation of an input (source) string into a (machine independent) quasi-terminal symbol string. Finite state recognizers. **3.** Syntax analysis: top-down compilation for LL(1) grammars using syntax graph driven analysers or recursive descent. Bottom-up compilation for simple- and weak-precedence and LR(k) grammars. **4.** Semantic analysis: program translation and code generation. **5.** Compiler generators: automatic generation of compilers for LALR(1) grammars. **6.** Code optimization by systematic program transformation. **7.** Run-time organization: activation record stacks, heap management.

6.646 Computer Applications — S1 L3T2

Prerequisite: 6.620 or 6.600 (C) or 6.021D or 6.621. Excluded: 6.622.

The use of computers for solving problems with a substantial mathematical and operational research content: includes use of some standard software packages. Topics selected from: discrete event simulation; the SIMULA programming language; pseudo random number generation; simple queueing theory; applications of mathematical programming; statistical calculations; critical path methods; computer graphics, artificial intelligence.

6.647 Business Information Systems — S2 L3T2

Prerequisite: 6.641. Excluded: 14.602, 14.603, 14.604, 14.605.

Introduction to accounting systems — general ledger, debtors and creditors; auditing and internal system controls; models of business information systems; integrated business systems. System specification, system analysis, system design and implementation; testing and debugging. Managing a project team, project control. The COBOL programming language. File organization and design; sequential, indexed sequential, random, inverted, B-tree file organizations; file updating. Includes an invited lecture strand presented by guests from commerce and industry. A major project, written in COBOL, is undertaken as a team exercise.

6.649 Computing Practice* — S2 L3T2

Prerequisite: 6.641. Co-requisites: 6.633 or 6.643 or 6.647.

Not offered in 1981.

For students majoring in Computer Science who seek a programming career in government or commercial industry. Topics, related to current computing practice, include: Comparative study of computer hardware in current popular use; Comparative study of the 'popular' programming languages, eg COBOL, RPG, BASIC, FORTRAN, PL/1, APL. Job control languages. Data Preparation procedures. Key-board enry. Verification. Word processing; report preparation; documentation. Social implications of computing. Professional responsibilities and ethics. Project management; software engineering; psychology of computer programming.

6.801 Electrical Engineering — F L1T2

Prerequisite: 1.001 or equivalent.

S1: an application-oriented introduction to electronics; a basis of circuit theory and elementary electronics; 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. S2: usage of electrical power in industry: the characteristics and selection of electrical machinery, its interface with the prime power supply, protection, electrical safety and compliance with Australian standards. Includes two projects illustrating the application of electrical engineering to various aspects of industry.

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

*Can only be counted with at least 3 other Level III Computer Science units.

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.

6.853 Analog and Digital Instrumentation S1 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.

6.854 Electrical Engineering S2 T4

Prerequisite: 1.001 or equivalent.

Extensive introduction to the theory and application of heavy current electrical engineering. Commences with the requisite circuit theory and then proceeds to consideration of the distribution of electrical power and the characteristics and selection of electrical machinery.

DC power supplies, three-phase AC supply, voltage regulation, transformers, AC and DC machines and their rating; a project illustrating the application of electrical engineering to various aspects of industry. Consists of two 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. Detailed lecture notes are provided.

6.855 Electrical Power Utilization S2 T4

Prerequisite: 6.851.

Introduction to the distribution and utilization of electrical power in industry. The characteristics and selection of electrical machinery, its interface with the supply, protection and electrical safety; a project illustrating the application of electrical engineering to various aspects of industry. Consists of two 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. Commences in week 4 of session 2.

6.902 Industrial Experience

A minimum of three years of appropriate industrial experience must be obtained concurrently with attendance in Course 3650. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

6.903 Industrial Training

Students enrolled in course 3640 must complete a minimum of 60 days industrial training. Students are required to submit to the School evidence from their employers confirming completion of the prescribed training.

6.911 Thesis

For students in the final year of their BE degree course.

Graduate Study*

6.050G Occasional Elective — Reliability Engineering II S2

Prerequisite: 6.044 or 6.376G or similar.

Reliability and availability analysis by Markov states. R & A analysis for non-exponential failure and repair time distributions. Reliability prediction by stress-strength-time models. Fault tree analysis. Failure data analysis. Component and equipment accelerated testing and screening. Failure mechanisms of electrical and mechanical hardware. Acceptance testing by variables. Statistical design. Bayesian interpretation of reliability tests. Reliability growth organisation. Cost of ownership. Warranties. Case studies.

6.053G Advanced Mathematics II C3

Mathematical techniques applicable to electrical engineering problems. Topics may include: an introduction to state variable theory. Green's functions, operator theory.

6.054G Numerical Computation C3

Topics include numerical solution of partial differential equations and approximation theory.

6.060G Microprocessor Systems S2 C3

Prerequisites: 6.021C and 6.021D, or 6.620 and 6.021E, or 6.631. Excluded: 6.0318, 6.613, 5.087G, 5.088G.

L.S.I. technologies and devices. Microprocessor integrated circuits. Outline of system configurations. Microprocessor busses, control signals and timing. Programming models and instruction sets. Programming including addressing modes, arithmetic and I/O. Memory devices including RAM, ROM, EPROM. Input/output devices and support chips. Parallel and serial I/O devices. Direct memory access. Interrupt systems. Microcomputer system devices including cassette tape, floppy disk, keyboards, LED and video displays. System development software including monitors, PROM programmers, editors, assemblers and higher level languages. Development tools, logic state analyzers, emulators. The course will include laboratory involving both hardware and programming experience.

6.071G Electrical Measurements C3

Electrical measurements of moderate precision. Theory and practice of deflection measurements and null techniques at DC and low audio frequencies.

6.073G Precise Electrical Measurements C3

Prerequisites: 6.0311, 6.0313, 6.041 or equivalent.

An advanced course primarily devoted to the special problems of precision measurements at DC and audio frequencies. Establishment of electrical standards.

*Subjects which do not have a session notation are not offered in 1980.

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 — Applied Optoelectronics S2 C3

Wave and particle nature of light. Photon emission and absorption. Characteristics of optoelectronic devices: photoconductive cells, solar cells, LED, PIN and avalanche photodetectors. Principles and applications of lasers. Electro-optic and acousto-optic modulation of laser light. Fundamentals of optical image formation. Spatial filtering. Design and implementation of optical fibre system. The lectures are supplemented by experimental work in optical data processing and design aspects associated with optoelectronic devices.

6.160G Field Theory in Electrical Engineering C3

Revision of metric transformations and co-ordinate systems. Solution of the Laplace and Poisson equations in the eleven Eisenhart co-ordinate systems in three dimensions. Extension to selected cases of the diffusion and wave equations.

6.161G Field Mapping C3

The Laplace and Poisson equations: complex variable techniques for 2-dimensional solutions. Graphical, experimental and numerical methods for 2- and 3-dimensional problems. The Helmholtz equation. Cases where solutions may be based on the Laplace equation. Review of selected examples in electrical engineering.

6.164G Microwave Antenna Theory and Applications C3

Co-requisite: 6.167G or similar.

An advanced level treatment of antenna design and analysis, including reflector antennas and phased arrays and their applications. Includes: A review of basic theory. analysis and synthesis of phased arrays. Reflector antennas; single and dual reflector systems. Tolerance theory. New concepts of primary radiator design. Optimization techniques. Primary feeds for monopulse radar. Antennas for navigation aids. Adaptive phased arrays and their application to radar, basic adaptive array algorithm, acquisition technqiues and implementation.

6.167G Propagation and Transmission of Electromagnetic Waves S1 C3

Fundamental concepts and analytical techniques of guided wave propagation and antennas. Waveguide theory; rectangular and circular waveguides, optical fibres and microstrip transmission lines. Numerical techniques; finite difference and finite element methods. Tropospheric and ionospheric propagation. Fading. Basic antenna theory. Aperture antennas. Phased arrays.

Required as a prerequisite or co-requisite for 6.164G, 6.169G, 6.170G, 6.337G, 6.338G and 6.349G.

6.169G Microwave Circuits: Theory and Techniques S2 C3

Co-requisite: 6.167G or similar.

Properties of microstrip transmission lines and the theory and design of microwave integrated circuit components and systems. Includes: microwave measurement techniques, waveguide components and applications.

6.170G Microwave Electronics C3

Co-requisite: 6.167G, 6.340G or similar.

The principles and applications of solid state and electron tube microwave devices. Includes: Gunn, IMPATT, TRAPATT and PIN diodes; mixers and detectors; space charge waves; travelling wave tubes, klystrons and crossed-field devices.

6.224G Electrical Insulation Engineering C3

Prerequisite: 6.202 or 6.222 or equivalent.

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 S1 C3

Prerequisite: 6.202 or 6.222 or equivalent.

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

Prerequisite: 6.222 or equivalent.

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 S1 C3

Prerequisite: 6.202 or 6.222 or equivalent.

Selection from: design test requirements. Forms of high voltage works test: alternating, impulse, switching surge and direct. Non destructive tests: dielectric loss angle, dispersion, partial discharge and insulation resistance. Methods of determining material condition: moisture content, gas in oil, impurities, electron microscopy including determination of aging and long life. Commissioning and site tests.

Demonstrations and projects to support the lecture material.

6.228G Power System Equipment S2 C3

Prerequisite: 6.202 or equivalent.

Includes study of the operating characteristics and major design features of the items comprising a power system, including alternators, power transformers, voltage and current instrumentation equipment, oil and gas insulated circuit breakers, isolators, overhead lines and components. Lightning arrestors and protection for lines and substations. Power and line coupling capacitors, bus bars, connectors, cables and bushings. Line carrier systems.

6.234G Power System Protection S1 C3

Prerequisite: 6.202 or equivalent: credit level or higher.

The theory and application of protective devices and systems, related to the protection of transmission lines, transformers, busbars and generators.

6.246G Power System Operation and Control C3

Prerequisite: 6.247G.

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 S1 C3

Prerequisite: 6.203 or equivalent.

Digital computer techniques for power system analysis. Review of topics in numerical analysis: simultaneous linear and nonlinear equations, numerical integration. Eigenvectors and eigenvalues. Sparsity programming techniques and optimal equation ordering. Network equations. Load flow. Short circuit analysis. State estimation. Stability analysis: steady state and transient. Long-term dynamic simulation.

6.248G Power System Planning S2 C3

Prerequisite: 6.247G.

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

Prerequisite: 6.247G.

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 6.350G.

6.251G Power Elective II C3

As for 6.350G.

6.256G Underground Systems C3

Prerequisite: 6.202 or equivalent.

A specialized course relating to developments and contemporary practices in underground systems for the transmission of electrical energy. The thermal and electrical properties, rating and economics of cable systems and their accessories for a range of voltages from the reticulation level through to transmission voltage levels.

6.257G Electric Power Distribution Systems C3

Prerequisite: 6.203 or equivalent.

The engineering problems of distribution systems including industrial power systems, stressing the electrical distribution system as an entity. Distribution system planning. Overall design criteria. Co-ordination of thermal ratings. Protection of distribution network: cables and overhead lines. Design and performance of individual plant items. Particular problems of urban and rural distribution systems. Demonstrations and project work.

6.336G Digital Communication Networks S2 C3

Prerequisites: 6.343G or similar. Some familiarity with probability, random processes, queueing theory and Markov processes is an advantage.

Provides an up-to-date coverage of key techniques and their underlying principles in two important areas of digital communications, namely: *Computer Communication Networks* including capacity assignment, time delay versus cost trade-offs, information flow control, queueing theory, concentration and buffering in store-and-forward networks, message and packet switching algorithms, protocols, routing and network topology. *Random Access Techniques* including time-division multiple access, ALOHA systems, spread spectrum systems, direct sequence systems, interference rejection, jamming margin, error correction techniques using block and convolutional codes.

6.337G Sound Broadcast Systems C3

Prerequisites: 6.167G, 6.341G or similar.

Theory and practice of sound broadcasting systems. Topics: *Specifications:* coverage, bandwidth, power. *AM radio:* studio equipment, sound equipment, medium and shortwave systems, transmitters, antennas. *FM radio:* stereotransmission, studio equipment, transmitters, antennas. *Recording equipment:* links, etc. *Distortion:* distortion in recorders, distortion and noise in various parts of the transmission path.

6.338G Television Systems C3

Prerequisites: 6.167G, 6.341G or similar.

Theory and practice of broadcast television systems. Topics: Representation of colour and luminance. Australian standards: synchronization, colour coding, reasons for choice. Other systems. Studio equipment: cameras, video recorders, etc, transmitters. Propagation problems, distortion. Receivers, Teletext.

6.339G Electroacoustics C6

Aspects of acoustics which are relevant to sound engineering. Includes: scalar wave equation, plane and spherical waves, plane piston as a sound source; analysis of mechanical and acoustical lumped systems; loudspeaker and microphone types, practical aspects; room acoustics; sound recording; the ear, loudness and annoyance; underwater sound; introduction to sound in solids.

6.340G Communication Electronics S1 C3

Modern electronics as used in communication systems. Includes: analogue and digital integrated circuits (including ADCs, DACs PLLs, VCOs, multipliers, etc, and a survey of the main digital IC families); high-frequency and noise performance of active and passive circuits, particularly those using transistors; transistor ratings; microwave ICs; microstrip, thick film, and thin film circuits; CCDs and SEW devices, and their use in signal processing; introduction to active and other filters; factors involved in the design of large electronic systems.

Prerequisite or co-requisite for 6.170G and 6.345G.

6.341G Signal Analysis S1 C3

Excluded: 6.042, 6.484G, 32.621G or similar.

The fundamental aspects of the analysis and processing of digital and analogue signals, with emphasis on random signals and noise. Includes: Generalized Fourier analysis; convolution, correlation, energy and power density spectra. Hilbert transforms; analytic signals and signals in systems. Sampling and digital processing of analogue signals, including digital filtering. The discrete Fourier transform (DFT) and the use of fast Fourier transform (FFT) algorithms. Random processes, the transmission of signals and noise through linear systems and non-linear devices. Poisson and Gaussian random processes. Estimation and measurement of power density spectra.

Prerequisite or co-requisite for 6.337G, 6.338G, 6.343G, 6.344G, 6.345G and 6.349G.

6.343G Digital and Analogue Communications S1 C3

Co-requisite: 6.042 or 6.341G or similar. Excluded: 6.323 or similar.

Fundamentals of modern telecommunications systems, including theoretical and practical aspects of: linear and non-linear analogue modulation (AM, SSB, FM, etc), digital signal transmission, pulse code modulation, computer communication, effects of noise in analogue and digital systems, error control, multichannel systems (FDM, TDM, etc), synchronization, relay systems, optimum transmitters and receivers. Prerequisite or co-requisite for 6.347G and 6.348G.

6.344G Communication Theory C3

Prerequisite: 6.341G or similar.

An advanced subject, mainly for potential research workers, concerned with the theoretical basis of information transmission and the design of optimum analogue and digital communication systems. Topics: Information theory of discrete and continuous systems, channel capacity, rate distortion theory and fidelity criteria. Information theory for two-way communication. Optimum detection and estimation of analogue and digital signals using maximum likelihood (ML), maximum a posteriori (MAP), minimum mean-square error (MMSE) etc, criteria. Includes Wiener and Kalman filtering, and optimum detection and estimation of linearly and non-linearly modulated, analogue or digital, signals.

6.345G Analogue and Digital Filters S1 C3

Co-requisites: 6.340G and 6.341G or similar.

Theory and practice of modern filter design, particularly the design of active and digital filters. Includes: overview of modern filter methods, the approximation problem for analogue and digital filters, active filters and digital filters. In addition: classical LC filters, sensitivity and parasitics, equalizer design, adaptive and/or nonlinear equalization, mechanical filters, other digital signal processing techniques.

6.347G Digital Communications S2 C3

Prerequisite: 6.343G or similar.

Advanced and unified treatment of digital transmission systems. Principal topics are: *Baseband ASK digital communication Systems* including inter-symbol interference, eye patterns, power spectral density, probability of error estimates and bounds, Nyquist criterion partial response signals (eg simple and modified duobinary). *Digital Modulation* including various types of shift keying modulation such as amplitude, amplitude and phase, offset amplitude and phase, phase, frequency and minimum shift keying (ASK, APSK, OAPSK, PSK, FSK and MSK), power spectral density, probability of error, signal constellations and system comparison. *Line Coding* including linear codes, alphabetic codes, non-alphabetic codes and their comparison. *Equalization* including linear, non-linear, adaptive and automatic equalization and Viterbi decoders.

6.348G Optical Communications S1 C3

Co-requisites: 6.167G, 6.343G or similar.

Optical communications, with emphasis on optical fibre communication. Includes: theory of optical fibre propagation, cable technology, LED and laser sources, optical detectors and receiver design, measurements on optical fibres, system performance, wide-band systems and future systems, applications to power and military systems.

6.349G Radar and Navigation Aids S2 C3

Co-requisites: 6.167G and 6.341G or similar.

Theory, performance and applications of various electronic location and navigation systems. Includes: review of basic radar theory, CW radar, pulse radar, pulse-Doppler radar, tracking radar, detection of radar signals in noise, error analysis, clutter suppression, multiple-target detection, theory of high-resolution radar, synthetic aperture radar, terrain-avoidance and terrain-following radar; aircraft landing systems; DME; radio ranges; hyperbolic navigation systems, Doppler navigation, satellite navigation.

6.350G Solid State Electronics Elective S2 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.

6.373G Semiconductor Devices S1 C3

Theory and characteristics of semi-conductor devices, notably bipolar transistors, field effect transistors, and thyristors. The course discards many of the simplifications and generalizations made in the undergraduate treatment of transistors.

6.375G Integrated Circuit Technology S2 C3

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

6.376G Reliability Engineering S1 C3

Excluded: 6.044.

Principles and applications of the reliability engineering concept, with equal emphasis on design analysis, developmental engineering, calculation and prediction of reliability and associated parameters, quality control, failure mechanisms, reliability testing, economic basis of reliability and on reliability improvement techniques. Applicable to both electronic and non-electronic systems.

6.377G Integrated Circuit Design S1 C3

Prerequisite: 6.0316 or equivalent.

An advanced course on the design of integrated circuits, including the properties and modelling of integrated circuit elements, dc and ac design of operational amplifiers, low-pass and bandpass circuits, digital gates and complex functions, computer-aided design.

6.378G Solar Energy Conversion C3

World and Australian energy resources. Solar energy and the environment. Characteristics of received solar radiation. Thermal conversion (including thermoelectric devices). Selectively absorbing surfaces. Biological methods of conversion. Fundamentals of photovoltaic generation. Present and future applications of photovoltaic cells. Solar energy storage, and system considerations. Solar energy: research for the future.

6.379G Solar Cells — Operating Principles, Technology, and System Applications S2 C3

Prerequisites: 6.0313 or equivalent.

Harnessing of sunlight by using solar cells to convert it directly to electricity. The properties of sunlight and of the semiconductors used in solar cells are reviewed and their interaction described. Factors important in the design of solar cells and the current technology used to produce cells. Likely future developments in this technology. System applications ranging from systems which are currently viable economically to residential and central power systems which may be a possibility for the future.

6.380G Data Acquisition and Analysis in Remote Sensing S2 C3

Prerequisites: 10.361 or similar.

Techniques for extracting and analysing features in remotely sensed data, with emphasis on data acquired by the LANDSAT series. Topics are taken from the following list.

Nature and characteristics of Earth monitoring space platforms including LANDSAT, SKYLAB and the GMS weather satellites and their data acquisition methods. Sensor types and characteristics. Satellite data formats and availability. Techniques for image reconstruction, enhancement and display including: histogram transformation, grey-scale transformation, detection and characterisation of texture, edge and line detection, filtering. Techniques for feature classification including: clustering and related statistical techniques such as maximum likelihood estimation, decision tree structures, decision theoretic techniques. Techniques for detection of particular static features, such as agricultural data, geological data, water, etc. It is expected that this aspect of the syllabus would be modified by the particular interests of the participants. Procedures for handling multitemporal (time-varying) data such as found in crop discrimination, resource monitoring, large-scale fires and inland floods.

6.433G Applied Microprocessor Design S2 C3

Prerequisite: 6.060G.

Aims to familiarize the systems designer with the architecture and applications of the rapdily expanding family of microprocessor hardware support devices for dedicated control functions. Topics include: review and comparison of bus protocols of common systems; architecture, programming and applications of specialized system support devices and peripheral control chips; single chip microprocessors, architecture and applications to dedicated control tasks.

Laboratory work includes individual design projects involving typical systems application of these devices.

6.452G Feedback Control S1 C3

An intensive series of lectures and tutorials for upgrading at graduate level those students who are deficient in the basics of control. Material covered includes both time and frequency domain approaches to the design of control systems for linear, continuous single input/single output plants. Topics include: Nyquist stability theory; root locus diagrams; Nichols charts; state feedback and observer design. Computer-aided design techniques are applied where appropriate.

6.453G Computer Methods of Optimization C3

Use of digital, analog and hybrid computers for the solution of optimization problems in engineering. Includes: constrained and unconstrained minimization, review of search techniques, optimal control and the two point boundary value problem, linear quadratic problems and minimum time schemes. All methods are implemented on the computer.

6.455G Systems Identification and Modelling 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 S1 C3

Provides fundamental concepts common to many formal abstract system theories reflecting different aspects of the physical systems, which are their bases.

Input-output, state transition, fuzzy, axiomatic-hierarchical and evolutionary representants will be reviewed with discussion based on differential and discrete models, and some form of pulsed automata.

Basic concepts presented include the state properties and basis functions for linear systems; equivalence and reduction, structure, decomposition and interconnection; complexity; accessibility of states and stability considerations.

6.457G Cybernetic Engineering C3

The fundamentals of cybernetic engineering, the genesis of cybernetics, machines modelled on life and the evolution to present day robots. Includes: biological information transmission (biochemical coding and control, genetic and neural), pattern recognition learning systems and perceptrons, sub-systems of the human brain, and 'functional' descriptions for a 'Cybernetic Brain', an introduction to industrial manipulators and third generation robots; self-organizing control for manipulators and robots and the social consequences of flexible automation with industrial robots.

6.458G Decision and Syntactic Systems for Digital Pattern Recognition S1 C3

Concepts and techniques in decision-theoretic pattern recognition systems with an in-depth study of both non-parametric and parametric methods. Includes: pattern, feature and classification spaces, feature selection, linear discriminant functions and training algorithms; piecewise linear, discriminant functions; decision rules; the Bayes framework, approximation of probability densities; clustering and dimensionality reduction. Structural pattern recognition, including such topics as formal linguistics, primitives, grammar and syntax analysis as a recognition procedure.

6.459G Control Computing S1 C3

Prerequisites: 6.412 and 6.021D.

Review of fundamental principles of digital and analog computation with special reference to the solution of engineering and control problems. Topics include: small computer systems architecture; process control interfacing techniques; machine language programming; operation of hybrid computers and their applications.

6.460G Real Time Computing and Simulation S2 C3

Simulation of industrial processes by the use of real time modelling techniques is now an acceptable method for the study of complex industrial plant, eg, fossil-fired boiler-turbines; 747 aircraft; nuclear reactors. The fundamentals of real time computing, with examples carried out on an EAI 2000 — PDP-11 computing system. Analog, digital and hybrid simulation techniques as applied to the solution of lumped and distributed parameter systems.

6.464G Applied Optimal Estimation and Prediction S1 C3

Prerequisites: 6.452G, 6.472G.

The data handling aspects of optimal estimation and prediction. Includes: optimal linear filtering, recursive filters, Kalman filter, Riccati equation and Wiener filter; optimal smoothing; fixed-interval, fixed-point and fixed-lag; non-linear variance estimation, statistical linearization, non-linear least-squares estimation. Applications include prediction using economic models, data smoothing in seismic data processing of oil exploration and navigational problems. Development of techniques with known physical system models as well as 'black box' models.

6.466G Computer-Aided Design of Multivariable Control Systems C3

Many control problems result from interaction between key variables and can only be solved by a multivariable analysis. This can be approached in the time domain, eg the linear quadratic regulator, or the frequency domain, eg the inverse Nyquist array. Methods available, their limitations and strengths, and integration and comparison of the time and frequency approach. Laboratory work using interactive programs on the Department's Varian computer. Topics include: time domain methods, pole shifting, state decoupling, optimal control; frequency domain methods, inverse and direct Nyquist methods, characteristic locus.

6.467G Digital Image Processing Systems, Scene Analysis and Machine Vision S2 C3

The fundamentals of image processing including such topics as visual perception and the image model; uniform and non-uniform sampling and quantization; image transforms; image enhancement, sharpening and smoothing; image restoration and least squares filtering; image encoding, mapping, quantizing and encoding; image segmentation and description, grammars, languages and similarity. Material oriented towards scene analysis and world models for industrial robots including scenes; labelling; hadows; shape information; structural descriptions and representing knowledge; computer vision for robots.

6.468G Computer Display Systems and Interactive Instrumentation C3

Prerequisite: 6.060G.

Man-machine-process communication and control, and associated microprocessor based instrumentation. Review of appropriate analog and digital technology. Microcomputer hardware and programming for interactive communication using both machine and high-level languages. Display devices, operating principles and performance limitations. Hardware and software techniques for computer-generation and processing of pictures. Colour and movement. Interactive design and graphics creation. The geometry of transformations and projections. Light pens and other input devices. Non-visual communications including speech input-output.

6.470G Advanced Topics in Control C3

Advanced topics taught either by visiting academics or staff members with specific research interest. Typical topics are: design case studies; current research problems and review of important papers; game theory; multi-input-output design. Stochastic control theory. Distributed systems (diffusion, display, etc). Functional analysis.

6.471G Systems and Control Elective C3

As for 6.350G.

6.472G Feedback Control II S2 C3

Prerequisite: 6.452G.

Models of Linear and Nonlinear Systems including lumped and distributed systems, continuous and sampled data systems. Fitting parameters to linear models by batch and recursive methods. State estimation. Systems with time delays and types of nonlinearities. Introduction to digital process control including algorithms for 3-term controllers, dead beat response systems and optimal control.

6.481G Biology and Physiology for Engineers C3

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

6.484G Biological Signal Analysis S1 C3

Excluded: 6.341G.

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

6.485G Medical Instrumentation C3

A critical survey of the theory and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories.

6.650G Computer Science Elective C3

As for 6.350G.

6.651G Digital Electronics S1 C3

Prerequisite: 6.021E and 6.0313, or 6.631.

Digital circuits and principles, sub-system organization, microprocessors, memory technology, interface design, integrated circuit technologies and characteristics.

6.654G Digital Systems S1 C3

Prerequisite: 6.021E. Excluded: 6.612.

Computer architecture, implementation and realization. Use of hardware description languages for the analysis, design and specification of arithmetic units, storage and control Microprogramming techniques.

6.655G Computer Organization and Architecture S2 C3

Basic principles of computer architecture. A comparative study of the architectural features of a number of significant computer systems.

6.656G Software Systems A S1 C3

Prerequisite: 6.641. Excluded: 6.643.

A theoretical and practical basis for subject matter within the following areas: compiler organization: data structures, table organization, list structures, trees, stacks, etc), lexical analysis, syntax analysis, code generation, code optimization. Portability: solutions to the problems of moving software systems between different mechanics. Compiler compilers: translator writing systems designed to provide facilities to aid the compiler writer.

6.657G Software Systems B S2 C3

Prerequisite: 6.631 and 6.641. Excluded: 6.632.

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

6.659G Data Bases and Networks S2 C3

Prerequisites: 6.641. Excluded: 6.633.

Data management, compression techniques, redundancy coding; indexing; hashing encryption and decryption. Data base management systems; data description languages; data manipulation languages; integrity and recovery. The relational view of data. Computer networks; digital data transmission; communication protocols; circuit switching; packet switching; packet routing, network performance. Current international standards and practice. Distributed data bases.

6.660G Programming II S1 C3

Prerequisites: 6.641. Excluded: 6.642.

Development and analysis of algorithms and data structures. Model of computation. Set manipulation problems. Trees: optimal, balanced, multiway. Graphs. Pattern matching algorithms. Dynamic programming. Balanced merge and polyphase sorting. Heaps. NP-complete problems.

6.661G Business Information Systems S2 C3

Prerequisites: 6.641. Excluded: 6.647, 14.602, 14.603, 14.604, 14.605.

Accounting concepts and terminology. Auditing, internal controls. Systems Analysis. Flowcharting. Decision tables. Models of business information systems. System design. Feasibility studies, presentation of designs, implementation testing. The COBOL programming language. Data files: sequential, random, index sequential, inverted. File updating. Data bases, integrated information systems.

6.662G Computing Practice C3

Prerequisites: 6.641. Excluded 6.649. Co-requisites: 6.659G or 6.661G or 6.656G.

For students majoring in Computer Science who seek a programming career in government or commercial industry. Topics, related to current computing practice include: Comparative study of computer hardware in current popular use: comparative study of the 'popular' programming languages, eg COBOL, RPG, BASIC, FORTRAN, PL/1, APL. Job control languages. Data Preparation procedures. Key-board entry. Verification. Word processing; report preparation; documentation. Social implications of computing. Professional responsibilities and ethics. Project management, software engineering; psychology of computer programming.

6.909G Project C9

6.918G Research Project C18

6.936G Research Project C36

Civil Engineering

Undergraduate Study

8.001 Industrial Training

Prerequisite: 8.670. Requirement for the Bachelor of Engineering Degree.

Students are required to complete a minimum of sixty working days of approved industrial training and submit a report on this training before the fourth week of Session 1.

8.002 Industrial Experience

Requirement for the Bachelor of Science (Engineering) degree.

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in the course. Students are required to submit to the School on enrolment in the final year evidence from their employers confirming completion of the prescribed period of industrial training.

8.011 Special Projects — SS L0T3

Equal to one technical elective.

A minor thesis or research project on any approved topic.

8.012 Elements of Architecture — SS L2T1

Introduction concerning the influence of structural technique in the past on architectural styles. Effect of modern structural engineering systems on architecture. Responsibilities of the structural engineer as a consultant.

8.013 Bridge Engineering — SS L1½T1½

Prerequisite: 8.1822.

An introductory subject in the design of road and railway bridges. Types of bridges, economic spans and proportions. Design loads and codes. Aspects of the design of steel, reinforced concrete, prestressed concrete, and composite bridges by empirical, elastic and limit state methods.

8.014 Computer Applications in Civil Engineering — SS L2T1

Prerequisites: 8.2733, 8.351, 8.360.

Advanced programming techniques such as the use of tapes, discs and plotter. Applications of advanced computational methods to structural analysis, geotechnology and flow problems.

8.015 Road Engineering — SS L2T1

Prerequisite: 8.671. Co-requisite: 8.2732.

Design of roads in urban and rural areas. Properties of asphalts and bitumens. Base course materials. Pavement design. Skid resistance. Performance evaluation.

8.016 Hydraulics — SS L2T1

Prerequisite: 8.573.

Use of hydraulic models for rivers and coastal works. Further studies in open channel flow and estuarine hydraulics.

8.017 Transportation Engineering — SS L2T1

History, development and characteristics of modes of transport. Fundamentals and evaluation of transport systems, performance and output. Interaction between land use and traffic demand.

8.018 Construction Engineering — SS L2T1

Prerequisites: 8.301, 8.671.

Advanced construction methods and techniques with special reference to major civil engineering projects under construction in Australia.

8.019 Railway Engineering — SS L2T1

Track geometry. Traffic systems. Design of rail beds. Properties of ballast and track materials. Design project. Railway development. Maintenance planning.

8.020 Hydrology — SS L2T1

Prerequisite: 8.582.

Flood estimation with particular reference to design and flood forecasting. Outline of current practices and recent developments. Discussion of possible/likely implications of recent developments for the practising engineer.

8.021 Environmental Aspects of Civil Engineering — SS L2T1

Prerequisite: 8.301.

Examination of the professional issues arising from the environmental impact of civil engineering planning, design and construction. Methodologies for environmental impact evaluation and general project evaluation. Environmental legislation, institutional procedures and decision-making processes. Case studies and project work in the above context.

8.023 Hydrodynamics **SS L2T1**

Prerequisite: 8.572.

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

8.024 Foundation and Dam Engineering **SS L2T1**

Prerequisite: 8.2732.

Foundations of structures and dams. Problems. Alternative foundation types. Treatment of foundation soils. Piling and grouting. Consolidation and drainage. Allowable settlement of structures. Settlement calculations. Design of earth and rock fill dams. Stability during construction and drawdown. Case studies of dam failures. Piping. Erosion.

8.025 Structural Failures **SS L2T1**

Prerequisites: 8.174, 8.1822.

Case studies of significant structural failures and distress during concept, construction, design and use. Modes, causes, consequences, responsibilities, corrective procedures.

8.026 Systems Methods in Civil Engineering **SS L2T1**

Prerequisite: 8.672.

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

8.027 New Materials I **SS L2T1**

Prerequisite: 8.2722.

History and development of polymers. Structure of polymeric materials. Properties and applications of thermoplastics and thermosets. Reinforced plastics; Fabrication. Structural Analysis and application to the design of FRP structures. Building adhesives, epoxies and ceramic wall tile fixing. Modified concrete, polymer concrete and glass fibre reinforced cement.

8.028 New Materials II **SS L2T1**

Prerequisite: 8.1822, 8.2722.

Theory and application of fibre reinforcements — glass and steel fibre reinforced cements, mortars and concrete composites. Shrinkage compensated and expansive cement — applications. Utilization of blast-furnace slag. Special aggregates and high strength concretes. New techniques of testing and removing concrete and reinforced concrete structures.

8.029 Continuum Mechanics **SS L2T1**

Prerequisite: 8.172.

Concept of continua, mathematical foundations, analysis of deformation, strain and stress, fundamental laws of continuum mechanics, constitutive equations, mechanical properties of solids and fluids, simple problems in elasticity.

8.030 Construction Management **SS L2T1**

Co-requisite: 8.672.

Civil Engineering Construction organization, management and control.

8.031 Construction Project Finance **SS L2T1**

Co-requisite: 8.672.

Civil Engineering construction project feasibility, financial management, cash flow, cost control, insurance and company finance.

8.032 Construction Law **SS L2T1**

Prerequisite: 8.672.

The legal system, court sources of legal information, areas of liability for the professional engineer. The basic rules and concepts of the laws of tort and contract, with particular reference to their application to construction work. Case studies of significant litigation involving construction engineers and their actions. Arbitration as an alternative means of settling disputes.

8.033 Industrial Law and Arbitration **SS L2T1**

Prerequisites: 8.672, 8.032.

Introduction to industrial law, including reference to Commonwealth and State statutory provisions dealing with conciliation and arbitration. State and Commonwealth awards. Industrial disputes. Employers' association. Trade unions. Introduction to real property and local government law.

8.034 Engineering Economy **SS L2T1**

Prerequisite: 8.672.

Economic evaluation of civil engineering projects, including benefit-cost analysis and rate of return analysis.

8.038 Special Topics in Reinforced Concrete Design **SS L2T1**

Prerequisite: 8.1822.

General design process; limit states concepts. Design for bending and compression; ductility. Biaxial bending. Shear and torsion. Serviceability design.

8.039 Computer Programming **SS L2T1**

Introduction to FORTRAN Programming, use of WATFIV compilers, flow charts and simple problems.

8.040 Advanced Engineering Geology **SS L2T1**

Introduction to structural geology rock types. Macro and Micro characteristics base studies. Fabric analysis. Defects in rocks. Representation of defects. Schmidt diagrams. Laboratory studies.

8.041 Geological Engineering **SS L2T1**

Prerequisite: 8.2721.

Site investigations. Techniques. Mechanical properties of rocks. Laboratory testing of rocks. Schmidt projections applied to slope stability. Flow of water in rock masses. Underground and open excavations. Rock blasting.

8.042 Water Resources **SS L2T1**

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

8.043 Public Health Engineering **SS L2T1**

Prerequisite: 8.581.

Water collection, transmission and distribution systems. Sewage collection and effluent disposal. Design of sewage treatment and water treatment processes. Principles of advanced wastewater treatment. Swimming pools. Refuse collection and disposal.

8.047 History of Civil Engineering **SS L2T1**

A study of the theoretical, practical and sociological aspects of the development of civil engineering, including its relationship to other disciplines.

8.051 Design Project — Materials

Final year design project in the field of civil engineering materials.

8.052 Design Project — Structures

*Prerequisite: 8.191.**

Final year design project in the field of structural engineering.

8.053 Design Project — Water

Prerequisite: 8.573 or 8.582 or 8.581.

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

8.054 Design Project — Engineering Construction

Prerequisite: 8.672.

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

8.055 Applied Structural Analysis **SS L2T1**

*Prerequisite: 8.191**

Practical applications of methods of structural analysis both for a small design office (with programmable calculator) and a design office of moderate or large size (with mini-computer, terminals and commercial programs.)

8.056 Practical Structural Design **SS L2T1**

*Prerequisite: 8.191**

Choice of structural system, approximate methods of analysis, preliminary proportioning of members. Checks on design calculations and computer output. Domestic structures; home-unit building design; steel industrial buildings; design of stairs and lift shafts; design of floor systems.

8.057 Special Topics in Prestressed Concrete **SS L2T1**

Prerequisite: 8.1821.

Historical development, methods of prestressing, general flexural theory, calculation of losses, anchorage zone design, partial prestressing.

8.058 Special Topics in Steel Design **SS L2T1**

Prerequisites: 8.174, 8.1821

Plastic analysis and design of steel members and frames. Elastic-plastic material behaviour, moment-rotation relations. Lower bound and upper bound theorems. Plastic design of steel structures.

8.059 Structural Vibrations **SS L2T1**

Prerequisite: 8.174.

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

8.060 Numerical Methods in Geotechnology **SS L2T1**

Prerequisite: 8.2732, 8.2733.

Introduction to finite element methods; application of finite element and finite difference techniques to various soil mechanics and rock mechanics problems such as stability analysis of foundations, retaining walls, tunnel openings; prediction of settlement of footings, piles and raft foundations; seepage and consolidation analysis.

*Students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject.

8.062 Construction Camp

Prerequisite: 8.672.

A one week field camp involving several of the following Falsework systems and field productivity measurements; Optimization of earthmoving equipment performance; Concrete pumping systems; Pile driving practice and the measurement of performance parameters; Bridge erection techniques; Rock drilling and blasting design and management; Formwork design and erection and concrete pressure measurements; Operation of earthmoving plant and demonstration of plant capabilities; Noise measurements on construction sites; Prestressing calculations and measurements on a full scale beam; Crane capacity and productivity measurements; Dewatering systems and measurement of well point performance; Site investigation; Compaction.

8.081 Probability and Statistics for Civil Engineers — SS L2T1

Prerequisite: 8.361.

Tests of hypotheses. Analysis of variance and co-variance. Stochastic processes; queues (single and multiple channels), Markov chains, simulation. Bayesian decision. Applications to structural, geotechnical, and water problems.

8.082 Numerical Methods for Civil Engineers — SS L2T1

Prerequisite: 8.362.

Introduction to finite element method, application of FEM to structural geotechnical and water engineering. Numerical techniques for the solution of eigenvalue problems. Optimization.

8.113 Civil Engineering for Electrical Engineers — SS L2T2

Includes an introduction to the various branches of civil engineering, the nature and organization of the profession. Relationship between clients and design consultants. The historical development of Civil Engineering.

Theory of beams and trusses, resultant forces, structural action, stress and strain. Relation between load, shear force and bending 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 L1T2

Prerequisites:

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

Planar concurrent and non-current forces. Equilibrium equations and graphical techniques. Internal actions in rigid bars. Statically determinate pin jointed plane trusses.

8.171 Mechanics of Solids I — SS L1½T1½

Prerequisite: 8.170.

Applications of laws of static equilibrium to structures. Concepts of stress, strain. Equilibrium, compatibility and stress-strain relationships. Stress and deformation due to axial force; linear and non-linear problems; compound bars. Concepts of stiffness and flexibility. bending moments and shear forces in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

8.172 Mechanics of Solids II — SS L2T2

Prerequisite: 8.171.

Structural statics. Bending moments, shear force and torsion. Stresses due to shear force in solid and thin-walled sections; shear centre. Torsion of circular, non-circular and thin-walled sections. Principal stresses and strains; yield criteria. Combined stresses. Concepts of instability.

8.173 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.

8.1811 Structural Design IA — SS L1T2

Prerequisite: 8.170, 8.171. Co-requisite: 8.172.

Introduction to design concepts: structural safety: strength and serviceability. Characteristics of structural materials. Design of statically determinate, laterally supported beams in reinforced concrete, steel and timber; behaviour at service loads and in the overload range up to failure; analysis from basic principles; design for strength and serviceability.

8.1812 Structural Design IB — SS L1T2

Prerequisites: 8.172, 8.1811.

Behaviour, analysis and design from basic principles of simple structural members and systems: reinforced concrete one-way slab and beam floor systems; T-beams; one-way slabs. Bond, anchorage and crack control. Composite steel-concrete beams. Axially loaded tension and compression members in steel and reinforced concrete. Simple steel trusses; welded and bolted (commercial bolts only) connections for axially loaded steel members.

8.1821 Structural Design 2A — SS L1T2

Prerequisite: 8.1812.

Approaches to design; limit states. Wind loading; design of wind-resisting systems. Behaviour, analysis and design from basic principles of simple structural members: Statically determinate prestressed concrete beams; effect of prestress on service load behaviour; full and partial prestress; moment and shear capacity; deflection calculation; end block design. Reinforced concrete beam-columns; interaction curves and design procedures.

8.1822 Structural Design 2B — SS L1T2

Prerequisite: 8.1812.

Behaviour, analysis from basic principles, and design of structural members and components: Laterally unsupported steel beams and plate girders; lateral and local buckling. Compression members with elastic end restraints. Steel beam-columns. Bolted and welded connections under eccentric loading; high strength bolts. Plastic design of steel continuous beams. Design and detailing of reinforced concrete continuous beams. Timber beams, compression and tension members, and connections. Deflection calculations.

8.191 Structural Engineering — SS L1½T1½

Prerequisites: 8.174, 8.182*.*

1. Variational theorems applied to rigid frames; non-linear analysis; stability analysis of framed structures. Plastic analysis of steel structures. Brief treatment of finite element methods, cable structures, arches, plates and shells.

2. Reinforced concrete two-way slabs. Flat slabs; static moment; simplified equivalent frame method for determination of design moments; punching shear. Plastic design of steel portal frames. Introduction to design of reinforced concrete retaining walls, and spread and strip footings.

8.271 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.

8.2721 Civil Engineering Materials I — SS L2T2

Prerequisite: 8.271.

Minerals, texture and fabric in rocks. Engineering significance. Classification of rock types. Surface processes, geological structures. Geological maps and projections. Soil formation and mineralogy. Clay minerals. Classification of soils. Basic soil properties. Cements, chemistry and major constituents, hydration products, effects on concrete properties. Aggregate materials for use in Portland cement concretes and their influence on concrete properties; principal test.

8.2722 Civil Engineering Materials II — SS L2T2

Prerequisite: 8.271.

Mechanical behaviour of materials. Response to loads. Yielding criteria and fracture. Effects of stress state, strain rate and temperature. Principles of fracture mechanics. Behaviour of typical materials. Metals engineering. Structure and properties of metals and alloys. Hot and cold working. Thermal treatments. Welding. Common processes for welding, metallurgical aspects and weldability. Occurrance of flows, testing of weldments, significance for engineers.

8.2731 Geotechnical Engineering I — SS L1T1

Prerequisite: 8.2721.

Basic soil properties and classification for engineering purposes; soil water, soil suction and the effective stress law; steady flow of water through soils; consolidation of soil masses; failure and shear strength of soils; stress strain characteristics of soils.

8.2732 Geotechnical Engineering II — SS L1T1

Prerequisite: 8.2731.

Site investigation principles and practice; compaction and mechanical stabilization for soil masses; lateral earth pressures and retaining wall analysis; bearing capacity of isolated foundations; settlement analysis of isolated foundations; slope stability analysis for natural and man made slopes.

8.2733 Rock Engineering — SS L1T1

Engineering properties of rock material and rock mass, elastic, plastic, creep and fracture behaviour of rock, continuum mechanics approach to rock behaviour. Application of rock mechanics principles to engineering problems. Case studies.

8.2741 Concrete Technology — SS L2T2

Prerequisite: 8.2721.

Properties of concrete. Structure and composition. Rheological models of fresh concrete. Mix design. Multi-phase theory of elastic behaviour. Bond with reinforcement. Creep and drying shrinkage. Durability, physical and chemical deterioration, permeability. Non-destructive testing. Special concretes and special techniques.

8.2742 Metals Engineering — SS L2

Prerequisite: 8.2722.

Application of metals in civil engineering structures; steels, aluminium alloys and other common metals. Design for avoidance of service failures. Corrosion, basic principles, causes and control. Fatigue and brittle fracture; relationships between material toughness, design stress, flaw size, stress concentrations and service conditions; effects of temperature, loading rate, restraint. Tradition and applied fracture mechanics approaches to fracture safe design. Welding, significance for the designer, quality requirements and control.

8.301 Systems Engineering — F L1T1

Prerequisites: 10.001, 5.0102, 8.670.

The systems approach to engineering problem formulation, modelling and decision analysis is presented in a course integrating analytical theory, case studies and project work. Relevant system modelling concepts, techniques and decision models are introduced during development of a project designed to encourage the student's own creative approach.

*Students who have failed this subject may apply for permission to enrol simultaneously in this subject and the subsequent subject.

8.311 Systems Engineering I† — SS L1T1

Prerequisites: 5.0102, 8.670, 10.001.

The systems approach to problem formulation and analysis by introduction to elements of systems theory and case studies relevant to engineering and project design.

8.312 Systems Engineering II† — SS L1T1

Prerequisite: 8.311, 8.360. Co-requisite: 8.361.

Formulation of engineering resource problems for numerical analysis and decision-making, and study of a selected set of numerical evaluation techniques.

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.

8.360 Computing — SS L1T1

An introduction to the use of higher level programming languages such as PASCAL and FORTRAN and the principles of program design. Computing techniques. Development of software and its applications.

8.361 Probability and Statistics† — SS L1T1

Prerequisite: 10.001.

Introduction to probability. Random variables. Elementary distributions. Sampling distributions. Statistical inference. Confidence limits. Regression.

8.362 Engineering Computations‡ — SS L2T1

Prerequisite: 10.022.

Solution of equations encountered in stress analysis. Eigenvalue algorithms for buckling and vibration problems. Finite difference solution to deflection of beams and plates, heat conduction, flow of fluids and wave propagation.

8.400 Transport Engineering I — SS L2T1

Discrete flow phenomena, definitive concepts — headway and counting distributions, speed distributions, service time distributions. Queueing and delay. Saturation Flow — programmed and non-programmed flow. Traffic networks: shortest path, maximum flow. Road traffic applications: highway and intersection capacity, travel time and delay; traffic control devices, lanes, medians, turn pockets, traffic signals, coordination.

8.401 Transport Engineering II† — SS L2T1

The land use/transport system — urban, regional and local systems. Definitive concepts and ideas — land use potential, transport impedance accessibility, traffic generation. Equations of state of a land use/transport system; feedback equilibrium. Land use transport planning process; land use, traffic generation, distribution, assignment and evaluation models. Strategic planning issues; optimization, sensitivity analysis, constraints and resources. Operational planning.

8.571 Hydraulics I — SS L1½T1½

Prerequisites: 5.0201, 10.001.

Fluid properties: hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations.

8.572 Hydraulics II — SS L1½T1½

Prerequisite: 8.571.

Dimensional analysis, hydraulic model theory, scale effect. Fluid turbulence, velocity distribution, surface resistance in flow past plane boundaries and in pipes and channels. Pipe flow, pipe networks, steady flow in uniform channels.

8.573 Hydraulics III — SS L1½T1½

Prerequisite: 8.572.

Channel flow, steady non-uniform flow, backwater curves, hydraulic jump. Flow measurement. Unsteady flow in pipes and channels. Hydraulic machinery, radial and axial flow, characteristic curves, cavitation.

†Available from 1982 onwards.
‡Available from 1983 onwards.

8.581 Water Resources I **SS L1½T1½**

A prior knowledge of elementary hydraulics is assumed.

Water pollution and water quality criteria. Sources of supply, collection, transmission and distribution. Quality requirements and treatment processes. Waste water collection: reticulation and pumping stations; effluent quality requirements; outline of treatment processes. Outfall structures and ocean disposal. Water reclamation.

8.582 Water Resources II **SS L1½T1½**

A prior knowledge of elementary hydraulics is assumed.

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

8.583 Water Resources III **SS L1T2**

Prerequisites: 8.572, 8.582.

Hydraulics of groundwater systems, application to regional problems. Water resources planning, systems approach, applied aspects of water engineering.

8.670 Introduction to Engineering Construction **SS L1T0**

Introduction to construction engineering, projects and decision agents, construction equipment and methods. A report required involving site visits on a construction operation.

8.671 Engineering Construction **SS L2T1**

Prerequisite: 8.670.

Role of professional construction engineer. Project breakdown into construction activities and operations. Engineering construction characteristics of equipment, materials and methods with emphasis on earthmoving, 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 microeconomic systems framework for application by the following decisionmakers: plant engineer, contractor, developer, local government engineer, and State/National engineering project managers.

8.674 Planning and Management III **SS L1T2**

Prerequisite: 8.672.

Project implementation, organization and control, field management techniques, industrial relations, field documentation and information flow, field change orders, risks, and delays, legal aspects, the relationship and duties between professional agents involved in projects.

8.711 Engineering for Surveyors I **SS L1½T1½**

Aspects of Hydraulics: fluid properties, hydrostatics, motion of fluids, continuity, energy and momentum aspects, closed conduit flow and open channel flow. *Aspects of Hydrology:* Scope and applications. Hydrologic measurements, rainfall analysis, storm rainfall-runoff relations, flood estimation. Urban drainage design.

8.712 Engineering for Surveyors II **SS L3T0**

Municipal Engineering. Soil Mechanics: Soil forming processes; pedological classification; engineering classification of soils; pavement design based on engineering classification; effective stress concept for saturated and unsaturated soils, sheer strength, flow of water through soils, consolidation; slope stability and earth pressures. *Public Utilities:* Relationship between urban development and each of water supply, wastewater and stormwater drainage, transport.

Servicing Subjects

8.112 Structures **S1 L1T2**

8.250 Properties of Materials **SS L2T2**

Graduate Study

8.401 Human Factors in Transport **SS C3**

Human capabilities, ergonomic principles, attitudes to new concepts, planning, the law; application to transport planning, design and implementation. The human as a processor of information, influence on design of transport facilities particularly information displays; signals, signs and lighting.

8.402G Transport, Environment, Community F C6

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity: government, bureaucracy and public involvement in transport policy and environment impact statements.

8.403G Theory of Land Use/Transport Interaction S1 C3

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state (functional, behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional, national).

8.404G Local Area Transport Planning S1 C3

Application of theoretical methods to local area planning. Local government planning and engineering: pedestrian planning, frontage land use problems, analysis of residential areas, industrial estates, shopping centres and recreational facilities, accessibility studies, environmental studies, parking studies.

8.405G Urban Transport Planning Practice SS C3

Analytical techniques for urban land use, transport planning practice. Planning methodology: traffic generation, trip distribution, modal-choice, traffic assignment, evaluation. Land use forecasting: calibration and verification of behavioural models, application of mathematical programming models, case studies, public transport problems.

8.406G Regional Transport Planning S2 C3

The role of transport in economic and social development in regions including Third World countries; historical and contemporary analysis. Analytical techniques for regional planning. Planning practice, feasibilities studies, evaluation methods. Case studies.

8.407G Transport System Design (Non-Urban) S1 C3

Process of location of road, railway and airport facilities. Data collection, alternative routes, public discussion, methods, techniques, aids, plans and diagrams produced. Geometric form: differences between road, railway and airport carriageway layout. Optical guidance, design models, landscape, provision for surface-water signposting, fencing and posts.

8.408G Transport System Design (Urban) S2 C3

Types of urban transport facilities. Distributors, streets, bicycle routes, walk-oriented areas, bus lanes and rapid transit lanes, stops and change terminals, noise control. Minimum geometric form; speed range controls, provision for surface water on urban roads, landscape. Design of intersections and parking areas.

8.409G Interchange Design SS C3

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

8.410G Highway Engineering Practice Part I S1 C3

Highway systems and organization. Roles and interaction of public and statutory highway and transportation authorities and research organizations. Sources and administration of highway finance. Highway programming. Feasibility studies. Engineering investigation and planning of highways and interchanges. Factors affecting long-term performance of transport facilities. Definition of design parameters. Factors of safety.

8.411G Highway Engineering Practice Part II S2 C3

Selection, comparison and critical evaluation of design procedures. Roles of ICES and other computer-oriented engineering systems in highway planning, design and construction. Maintenance systems. Economic modelling, investment costs. Prediction of performance. Implementation and revision of design decisions. Optimal use of resources. Project management for roads and interchanges. Choice of construction techniques. Upgrading of existing facilities, stage construction.

8.412G Economics for Transport Studies S1 C3

Introductory macro and micro economic theory. The pricing mechanism in transport and distinctive characteristics of transport demand and costs. National income and social accounts with particular reference to the transport sector. Economics of public enterprise. Cost-benefit analysis and modelling. Engineering economics (compound interest) and budget determination. Econometrics. Selected special problems in the economics of transport modes.

8.413G Transport Economics S2 C3

Cost and price analysis of each of the transport modes (road, rail, air and sea). Welfare analysis and taxation theory with respect to transport. Economics of location; economics of land use models; regional trade model.

8.414G Transport Systems Part I S1 C3

Definition of basic traffic elements, zero flow travel time, capacity, impedance/flow relationship. Transport Networks. The determination of shortest path, maximum flow, in networks. The topological description of networks. System parameters, performance. Application of network analysis to existing road, rail and air transport systems.

8.415G Transport Systems Part II — S2 C3

Historical introduction to transport systems and development of various transport modes; road (vehicles, pedestrians, cycles), conveyor, rail, sea and air. Analysis of the operational characteristics of vehicles in the transport modes of road, rail and air. Analysis of the requirements of the rights of way for each transport mode. Development of optimum criteria for the distribution of cargo and passenger traffic. Terminals and mode transfer facilities. Development of system operational models. Energy consideration, new systems.

8.416G Traffic Engineering — F C6

Road Inventory: traffic measurements; flow, speed, origin-destination, accidents, road structure. Road capacity: controlled and uncontrolled intersections, highways and freeways. Signal systems. Traffic operations and control; arterial and network systems. Parking. Hazard analysis and safety improvements. Enforcement. Bus service operation.

8.417G Transport and Traffic Flow Theory — F C6

Analysis of deterministic and stochastic models of the traffic stream. Topics covered include the following: Definition and measurement of traffic stream parameters. Space and time distribution of speed. Overtaking models and the moving-observer method. Fundamental diagram of traffic. Car-following theory. Headway and counting distributions. Introduction to queueing theory. Simulation techniques. Signalized and unsignalized intersections.

8.418G Statistics for Transport Studies Part I — S1 C3

Data collection and processing. Probability, variates, sampling of values. Standard distributions, sampling distributions. Inference: point estimation, hypothesis testing and interval estimation; power, confidence, sample size. Regression. Generating functions. Sums of random variables. Distribution-free inferences.

8.419G Statistics for Transport Studies Part II — S2 C3

Linear models. Analysis of variance and co-variance. Simple and multiple regression. Design of experiments, interpretation of results. Sample survey design and analysis.

8.420G Transport Engineering Elective — SS C3

An occasional offering in a specialized Transport and Highways topic selected according to current demand and/or availability of a local or visiting specialist.

8.701G Economic Decision Making in Civil Engineering — C3

Review of practical engineering decision-making problems and relevant techniques. Engineering economics, benefit/cost analysis, consideration of inflation and taxation in investment decisions, bidding, decision theory, microeconomic theory, objectives and criteria, multiple objective planning.

8.702G Network Methods in Civil Engineering — C3

Graphs, flow-in networks, optimal paths, critical path schedule, resources levelling, simulation networks, stochastic networks, project management, further applications.

8.703G Optimization Techniques in Civil Engineering — C3

Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.704G Stochastic Methods in Civil Engineering — C3

Queueing, Markov processes, theory of storage, reliability, renewal, application, transportation and allocation.

8.705G System Modelling — C3

The development of system models for specific problem areas and decision positions. Problem environment, goals, objectives, and definition established by field contact and team discussion, information flow requirements and the design of user-oriented decision processes. Class size is limited to selected students.

8.706G Experimental Methods in Engineering Research — C3

Purposes of experimentation in engineering research. Design of experiments; factorial and other designs; replication. Analysis of experimental data: analysis of variance and covariance; spectral analysis; other statistical methods. Decision theory.

8.710G Advanced Topics in Optimization in Civil Engineering — C3

Special studies in optimization in Civil Engineering design and construction to be offered from time to time by appropriate specialists.

8.714G Advanced Topics in System Modelling — C3

Special studies in system modelling to be offered from time to time by appropriate specialists.

8.723G Construction Design — C3

Design of field services and structures; compressed air services, cofferdams, ground anchors, floating plant, formwork and falsework, bridge centring, well-points and dewatering systems.

8.724G Construction Technology C3

A selection of topics from: drilling, blasting techniques, tunnelling, rock-bolting and other ground support, earth/rock transport, harbours, railways, dams, bridges, structural steelwork techniques, pipeline construction, foundation grouting, compressed air work.

8.725G Construction Accounting and Control C3

Engineering economic planning, control of labour, plant and materials. Insurances. Financial accounting. Project finance and taxation. Management accounting techniques and cost controls.

8.726G Construction Law and Professional Practice C3

Nature and sources of law, court procedures, interpretation of documents, evidence, technical opinions. Contract law. Company law. Arbitration. Duties of an engineer.

8.727G Construction Planning and Estimating C6

Project initiation and development, feasibility studies, planning and estimating procedures, contract administration; estimating 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.

8.731G Project Management C3

A problem-oriented approach to Project and Mission management; the nature of engineering and construction projects; the project team; behavioural aspects of project management; the organization and management of project resources; short term field planning and management strategies.

8.732G Advanced Project Management Theory C3

A theoretical and formative approach to Project and Mission Management; management strategies and project success evaluation techniques; organizational and behavioural aspects of the project team structure; behaviour norms and their impact on project team motivation; project management decision processes; case studies in project management.

8.748G Pavement Materials I C3

Properties and usage of soil and rock as pavement materials in road, rail or other construction work. Modification and evaluation of these properties; criteria for use and acceptance testing; variability and quality control: requirements of crushed rock for surfacing: use of non-standard materials in pavements: materials resources: in service conditions and their effect on materials performance.

8.749G Pavement Materials II C3

Properties and usage of bitumens, asphalts, tars and concrete as pavement materials in road, rail, airfield or other construction work. Rheology of bitumens: bituminous coating of aggregates and the optimization of bituminous mixtures: asphaltic concrete. Bituminous sealing practic and theory. Bituminous soil stabilization: concrete pavement mixtures, reinforcement and placement. Concrete-bitumen mixtures. Reinforcement materials for pavements. Bituminized membranes. Quality contrôl and performance of bituminous and concrete pavement materials.

8.750G Pavement Design and Evaluation I C3

Pavement types for road, rail, airfield and other works: Stress distribution in pavements, theoretical and actual: sub-grade conditions and traffic loadings: design principles methods, and criteria for flexible pavements: design principles, methods and criteria for rigid and semi-rigid pavements, including stabilized soil and multilayer pavements: design principles, methods and criteria for design of railtracks. Design of special-duty and temporary pavements.

8.751G Pavement Design and Evaluation II C3

Evaluation of pavement condition. Pavement instrumentation. Types of pavement distress, their origins and remedy. Roughness and skid resistance. Environmental influences and effects. Pavement maintenance for flexible and rigid pavements. Overlays. Special Maintenance requirements for airfields and railtracks. Maintenance scheduling. Systems design for rigid and flexible pavements for optimization of cost-benefit.

8.752G Terrain Engineering C6

Basic geology, geological processes and geomorphology as they affect the planning of engineering works and construction. Specific civil engineering applications for highways, water storages, buildings, civil and military transport operations, etc. Photo interpretation, ground surveying, terrain mapping, information storage and retrieval.

8.753G Soil Engineering C3

Soil pedology, fabric studies. Soil stabilization with cement, lime, bitumen and others. Grouting. Special techniques of piling. Soil anchors, slurry trench design. Freezing and thermal soil treatments. Vacuum and Electro osmotic dewatering. Advanced techniques for the in site measurement of soil properties. Variability of safety factors.

8.754G Applied Soil Mechanics C3

A detailed study of rigid and flexible retaining structures, and of slope stability using both traditional and recent analytical methods. Applications of plasticity theory, refined failure surface analysis and the finite element method.

8.755G Materials of Construction (Concrete Technology) I C3

Concrete as a structural material. Basic Structure; strength microcracking and failure mechanisms; significance of tests and relation to design requirements. Variability, target strength, code and special criteria for acceptance and rejection of concrete. Non-destructive testing. Accelerated curing and special high-strength concretes for column and prestressed construction. Recent developments in constitu-ent materials, special cements and admixtures. Workability, mix design theories and practical applications.

8.758G Soil Mechanics C3

A critical review of the theories of real soil behaviour and their implications for the selection of soil parameters for use in engineering design. Examination of the actual stress-strain and shear strength behaviour of saturated and unsaturated soils under static and dynamic conditions; survey of modern soil mechanics testing techniques; influence of real soil behaviour on the performance of scale models.

8.760G Materials of Construction (Concrete Technology) II C3

Concrete as a structural material, with special application to marine structures. Volume changes, shrinkage and thermal stresses; creep; predicated and design values. Cracking of plain and reinforced concrete, fracture toughness and extensibility; cracking problems caused by volume changes and creep effects in mass and offshore-type structures. Bond and impact strengths. Durability and fatigue of reinforced and prestressed concrete. Types of durability breakdown, sea water attack, FIP and other design recommendations and current research for marine structures. Special concretes.

8.764G Composites in Civil Engineering C3

History; relationship between structure and mechanical and physical properties. Elastomers, adhesives, reinforced plastics natural composites. Applications and case studies.

8.766G Welding in Structural Engineering C3

Terminology, welding processes, metallurgy, weldability of ferrous and non-ferrous metals, pre-heat and post-heat treatments residual stresses and distortion, weld quality levels, destructive and non-destructive testing, economic welded design, quality assurance.

8.771G Foundation Engineering C6

A specialized study of theoretical and practical aspects of geotechnical engineering directly relevant to the analysis and design of foundation systems. The primary object of the course is to establish the state-of-art with particular emphasis on the application of recent theoretical developments to foundation engineering, including piles, rafts, raft-piles, laterally loaded piles, retaining structures and techniques of strengthening soils.

8.773G Materials of Construction (Metals) III C3

Previously 8.756G.

Use of metals as structural materials: specification; structural aluminium alloys; modern steels; philosophy of materials selection; properties, applications, limitations; behaviour under mechanical loading; effects of environment; corrosion and corrosion protection.

8.774G Soil Dynamics C3

Fundamentalse of vibrations: wave propagation in elastic; homogeneous medium; wave propagation in layered medium; vertical, sliding, torsional and rocking motion or footings on elastic half-space; behaviour of dynamically loaded soils; design procedures for dynamically loaded foundations.

8.775G Geotechnical Aspects of Natural Hazards C3

Basic principles involved in earthquake engineering: treating on seismic waves; earthquake effects on foundations of buildings, dams slopes and embankments, intake towers, etc. Criteria for earthquake resistant design: landslides and their effects on soil slopes; probabilistic evaluation of slope failures; treatment of slopes; liquefaction.

8.776G Rock Mechanics C3

Strength and deformation characteristics of rock mass and joints: flow through joints and porous rock; failure criteria; stresses and deformations around underground openings; tunnel lining and rock anchors; stability of rock slopes; stabilization of rock slopes; stability of underground excavations related to mining; foundations of dams in fissured and layered rocks.

8.777G Numerical Methods in Geomechanics C3

Fundamentals of finite element and boundary element methods: deformation and flow problems; linear and non-linear analysis; applications to underground opening, stability of slopes, foundations, mining excavation; seepage and consolidation; soil-structure interaction problems; earth pressures, retaining walls and buried pipes; thermal stress analysis.

8.778G Geotechnical Processes for Energy Resources C3

Principles of rock fragmentation: blasting patterns; prediction and estimation of ground vibrations; damage criteria; numerical techniques for the prediction of rock fracture; grouting materials and techniques.

8.780G Geological Engineering C3

Rock stability investigaitons, mapping of exposed structures, in-site strength and deformation measurements. Drilling techniques, logging and representation of engineering geological information. Photogrammetric mapping and techniques. Classification of discontinuities in rock and mechanics of faulting and fracture. Strain analysis for rock masses.

8.802G Elastic Stability I **C3**

Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames.

8.803G Elastic Stability II **C3**

Energy methods of formation of stability problems. Approximate methods. Thin-walled open section struts; lateral buckling of beams; bending and buckling of thin plates.

8.804G Vibration of Structures I **C3**

Review of basic aspects. Analysis of lumped mass systems with varous degrees of freedom. Vibration in beams and other continuous structures.

8.805G Vibration of Structures II **C3**

Vibration of buildings. Earthquake and blast loading. Bridges under moving loads. Vibration effects in foundations. Generalised dynamics and Lagrange's Equations.

8.806G Prestressed Concrete I **C3**

Historical development. Methods of prestressing. Elastic analysis and design. Flexural capacity and shear capacity of prestressed elements.

8.807G Prestressed Concrete II **C3**

Analysis and design of statically indeterminate structures. Methods of securing continuity. Composite structures.

8.808G Prestressed Concrete III **C3**

Partially prestressed concrete; cracked section analysis; crack control and deflection calculations; determination of appropriate level of prestress; strength calculations. Rational design procedures for prestressed members. Continuous beams; secondary moments; practicel design procedures.

Prestressed slabs; two-way slabs; flat slabs; load balancing approach to design; effect of tendon distribution; design procedures; flexural and shear strength; deflections.

8.809G Reinforced Concrete I **C3**

Historical development. Methods of analysis and design, including limit state concepts. Analysis and design for bending, compression and combined bending and compression. Shear and torsion. Serviceability requirements.

8.810G Reinforced Concrete II **C3**

Creep and shrinkage effects in concrete structures. Application of limit theorems to structural concrete. Lower bound methods of design. Analysis and design of plates and slabs. Slenderness effects in columns.

8.811G Reinforced Concrete III **C3**

Preliminary design of concrete structures. Detailing of members and connections for strength and serviceability. Joints. Fatigue effects. Composite construction. Design of multi-storey buildings. Marine structures.

8.812G Plastic Analysis and Design of Steel Structures I **C3**

The perfectly plastic material; the plastic hinge; plastic collapse of beams and frames; basic theorems; general design methods.

8.813G Plastic Analysis and Design of Steel Structures II **C3**

Estimation of deflections; factors affecting plastic moment; shake-down; three-dimensional plastic behaviour; minimum weight design.

8.814G Analysis of Plates and Shells **C3**

Stress and strain in thin elastic plates bent by transverse loads. Solutions of the plate equation. Applications. Stress and strain in thin plates loaded in the plane of the plate. Applications.

8.817G Experimental Structural Analysis I **C3**

Dimensional analysis and principles of similitude, model analysis and design of models. Instrumentation and special methods of measurement. Evaluation of data.

8.818G Bridge Design I C3

Historical development. Design philosophies. Loadings and factors of safety. Design of slab and slab-and-beam bridges; skew and stiffened-kerb bridges, multibeam bridge decks. Analysis of orthotropic plates and grid frames. Plate web girders and box girders.

8.819G Bridge Design II C3

Advanced bridge design. Box girder and cable-braced bridges in steel and reinforced concrete. Orthotropic plate construction. Design of bridges by limit state methods. Serviceability requirements.

8.820G Structural Analysis and Finite Elements I C3

Stiffness analysis of structures. Basic of finite elements: Princple of virtual work, variational theorems, constraint equations. Effects of in-plane rigid floors and axially rigid members on the behaviour of multi-storey frames.

8.821G Structural Analysis and Finite Elements II C3

Variational formulation of finite elements. Plane stress and plate-bending elements. Mesh grading. Flat slabs and flat plates in building frames. Hybrid elements and shear wall analysis. Isoparametric elements, numerical integration. Finite elements methods in numerical analysis.

8.822G Structural Analysis and Finite Elements III C3

Application of the finite element method to analysis of structures. Verification of the results of standard computer programs. Structural stability and vibration of structures.

8.830G Hydromechanics C3

General equation of fluid motion, potential flow, conformal mapping, laminar flow, Navier-Stokes equations; turbulence, shear flows, jets and wakes, boundary layers, turbulent mixing, diffusion, air entrainment, cavitation, stratification.

8.831G Closed Conduit Flow C3

Theories for energy loss in conduit flows, roughness at pipe walls and tunnels, design applications. Caviation in conduits, transport of water borne mixtures in pipes, accuracy of flow measurement in pipe lines.

8.832G Pipe Network and Transients C3

Multiple and branching pipes, energy distribution in pipe systems. Computer solution of pipe network problems. Unsteady flow in pipes. Branching pipes and reflections. Effect of pumping plant behaviour.

8.833G Free Surface Flow C3

Theory of water flow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

8.835G Coastal Engineering I C3

Theory of periodic waves as applied to tides and wind generated waves in water of varying depths. Wave and tide prediction.

8.836G Coastal Engineering II C3

Wave forces on structures, shore processes and beach erosion. Estuarine hydraulics, wave and tide models.

8.837G Hydrological Processes C3

Hydrologic cycle, water and energy balances, atmospheric moisture, precipitation process, evaporation and transpiration, storm runoff process, land use and management, stream gauging, instruments.

8.838G Flood Design C3

Introduction to flood estimation, design rainfall data, hydrograph analysis, storm runoff, loss rates, rational method, unit hydrographs, introduction to urban drainage design, flood frequency.

8.839G Advanced Flood Estimation C3

Flood routing, catchment characteristics, runoff routing, synthetic unit hydrographs, urban runoff, regional empirical flood estimation methods, advanced unit hydrograph theory.

8.840G Reservoir Design and Yield Determination C3

Storage-yield analysis, extension of runoff records, deterministic catchment models, stochastic hydrology, storage probability studies, spillway capacity and reservoir flood routing.

8.841G Hydrometeorology C3

Water and energy balances, atmospheric moisture, precipitation, evaporation and transpiration, snow and snowmelt, extreme precipitation.

8.842G Groundwater Hydrology C3

Confined and unconfined aquifers, analogue and digital models of aquifer systems, water movement in the unsaturated zone, recharge, groundwater 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.

8.846G Urban Drainage Design **C3**

Excluded: 8.838G.

Introduction to flood estimation design, rainfall data hydrograph analysis, storm runoff, loss rates, rational methods.
Urban drainage design.

8.847G Water Resources Policy **C3**

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

8.848G Water Resource System Design **C3**

Principles of the optimal design and operation of multiple purpose, multiple component, water resource systems; evaluation of cost and benefits in complex and simple systems.

8.849G Irrigation **C3**

Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement; irrigation efficiency. Design of irrigation systems, appurtenant works, distribution.

8.850G Drainage of Agricultural Land **C3**

Characteristics of drainage systems, steady and unsteady state drainage formulae, conformal 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.

8.854G Solid and Liquid Waste Management **C2**

Sources and nature of refuse-collection and transportation-disposal: sanitary landfill, incineration, pyrolysis, resource recovery, composting. Collection, treatment and disposal of strong liquid wastes.

8.855G Water and Wastewater Analysis and Quality Requirements **C3**

The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

8.856G Water Treatment **C3**

Application of processes and process variations used to upgrade the quality of water for specified uses, with particular reference to the treatment of water for municipal use.

8.857G Sewage Treatment and Disposal **C3**

Application of processes and process variations used to improve the quality of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal.

8.858G Water Quality Management **C3**

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and re-use systems.

8.860G Investigation of Groundwater Resources I **C3**

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources II **C3**

Geophysical methods, remote sensing, photointerpretation, arid-environment studies, analog models, case studies.

8.862G Fluvial Hydraulics **C3**

Unsteady and varied flow in non-uniform channels, secondary currents, sediment transport, channel morphology, scour and shoaling, river control works, modelling of fluvial processes.

8.863G Estuarine Hydraulics **C3**

Classification of estuary types and their characteristics. Tides, their origin, prediction and effect on estuarine circulation. Entrainment and mixing process in estuaries. Salinity intrusion, tidal flushing, dispersion of pollutants. Sediment transport, channel stability.

8.901G Civil Engineering Elective I **C3**

A Session 1 occasional elective on a civil engineering topic, selected according to current demand and availability of local and visiting specialists.

8.902G Civil Engineering Elective II **C3**

A Session 2 occasional elective on a civil engineering topic, selected according to current demand and availability of local and visiting specialists.

8.909G Project **C9**

8.918G Research Project **C18**

Mathematics

Undergraduate Study

10.001 Mathematics I **F L4T2**

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*21-100*
or	
4 unit Mathematics	*1-100*
or	
10.021B	

Excluded: 10.011, 10.021A, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra an introduction to abstract algebra, elementary computing.

10.011 Higher Mathematics I **F L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
3 unit Mathematics	*71-100*
or	
4 unit Mathematics	*11-100*

Excluded: 10.001, 10.021A, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.022 Engineering Mathematics II **F L2T2**

Prerequisite: 10.001 or 10.011.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

10.031 Mathematics **F L1T1**

Prerequisite: 10.001 or 10.011 or 10.021C(Cr).

Differential equations, use of Laplace transformations, solution by series; partial differential equations and their solution for selected physical problems, use of Fourier series; multiple integrals, matrices and their application to theory of linear equations, eigenvalues; introduction to numerical methods.

10.033 Electrical Engineering Mathematics III **F L1½T½**

Prerequisites: 10.111A, 10.1113, 10.1114, 10.2111, 10.2112.

Numerical Analysis: Interpolation, roots of equations, approximation of definite integrals. Difference equations, Z-transform. Approximate solution of ordinary differential equations. Approximate solution of matrix problems, matrix inversion, eigenvalue and eigenvector problems.

Partial Differential Equations: Characteristics. Continuous and discrete Fourier transforms. Autocorrelation. Spectral density. Laplace transform. Potential theory. Numerical solution of parabolic, elliptic and hyperbolic partial differential equations.

Optimization.

10.111A Pure Mathematics II — Linear Algebra **F L1½T1**

Prerequisite: 10.001 or 10.011.

Vector spaces, linear transformations and matrices, change of basis. Eigenvalues and eigenvectors, generalised eigenvectors. Functions of matrices. Linear systems of differential equations including the use of Laplace transform. Inner products, orthogonalization, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1113 Pure Mathematics II — Multivariable Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.1114 Pure Mathematics II — Complex Analysis **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011.

Analytic functions, Taylor and Laurent series, integrals Cauchy's Theorem, residues, evaluation of certain real integrals.

10.2111 Applied Mathematics II — Vector Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011.

Vector fields; divergence, gradient curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics II — Mathematical Methods for Differential Equations **S1 or S2 L1½T1**

Prerequisites: 10.001 or 10.011.

Series solution of ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series, Bessel functions.

10.341A Statistics SU (Part A) **S1 L1½T½**

Prerequisite: 10.001 or 10.011.

An introduction to probability theory, random variables and distribution functions. Sampling distributions, including those of X^2 and t. Estimation methods, including an introduction to Least Squares and confidence interval estimation.

10.341B Statistics SU (Part B) **S2 L1½T½**

Prerequisite: 10.341A.

Further least squares and interval estimation procedures (including the user of the F distribution), with applications.

10.351 Statistics SM **F L1T½**

Prerequisite: 10.001 or 10.011.

For students in Aeronautical, Industrial and Mechanical Engineering and Naval Architecture as part of 5.071 Engineering Analysis.

An introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial, Poisson and normal distributions. Sampling distributions: with emphasis on those derived from the normal distribution: t, X^2 and F. Estimation of parameters: the methods of moments and maximum likelihood and confidence interval estimation. The standard test of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

10.361 Statistics SE **F L1½T½**

Prerequisite: 10.001 or 10.011.

For students in the School of Electrical Engineering.

An introduction to probability theory, Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of X^2 and t. Estimation by moments and maximum likelihood; confidence interval estimation. The standard tests of significance based on the above distribution with a discussion of power where appropriate.

An introduction to linear regression, auto-regression. Probability limit, law of large numbers and central limit theorem. Multivariate normal distribution. Stochastic processes in discrete and continuous time: Poisson and Gaussian processes.

Graduate Study

10.061G Advanced Mathematics for Electrical Engineers **C3**

Boundary value problems in partial differential equations. Selected topics from complex variable analysis, integral transforms, and orthogonal functions and polynomials.

10.361G Statistics **C3**

Probability theory; a survey of random processes with engineering applications — processes in discrete and continuous time. Markov processes, ergodicity, stationarity, auto-correlation, power spectra, estimation of auto-correlation and power spectra.

10.371G Statistics **C3**

Revision of probability and distribution theory, including estimation of hypothesis testing. Extension of this to include topics such as more complex probabilistic modelling, analyses of modified data (censored, truncated and missing observations), general statistical inference (decision theory), acceptance testing, and reliability analysis (hazard functions).

Accountancy

Undergraduate Study

14.001 Introduction to Accounting A **S1 L2T0**

An introduction for non-commerce students to the nature, purpose and conceptual foundation of accounting, information systems including accounting applications. Analysis and use of accounting reports.

14.002 Introduction to Accounting B **S2 L2T0**

Prerequisite: 14.001.

An introduction for non-commerce students to managerial accounting. Long-range planning, budgeting and responsibility accounting; cost determination, cost control and relevant cost analyses.

Graduate Study

14.042G Industrial Law **C2**

The elements of the law of contract and tort as applied to industrial law; the New South Wales and Commonwealth industrial arbitration systems, including award making and interpretation, and industrial disputes; workers' compensation.

14.062G Accounting for Engineers **C3**

Problems related to industrial situations, and their relevance in decision-making. Manufacturing and cost accounts, budgeting and budgetary control, cost analysis and control and profit planning.

Economics

Industrial Relations

Undergraduate Study

15.501 Introduction to Industrial Relations **S1 or S2 L2T1½**

For students enrolled in Faculties other than Commerce and Arts. Designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Includes: the origins, evolution and operation of the Australian system of industrial relations; the structure and role of trade unions and employer bodies; the function of industrial tribunals such as the Australian Conciliation and Arbitration Commission and the NSW Industrial Commission; wages structure and determination; employment, unemployment and retraining; the nature and causes of strikes and other forms of industrial conflict; the processes and procedures for conflict resolution.

Where appropriate to class composition, particular attention is paid to individual industries.

Industrial Engineering*

Undergraduate Study

18.003 Numerical Methods/Industrial Experimentation **S1 L1T½ S2 L1½T½**

Prerequisites: 5.072, 10.001, 10.022.

Numerical methods: numerical solution of systems of linear and non-linear equations. Numerical interpolation, differentiation and integration. *Industrial experimentation:* planning experiments. Common probability distributions. Experiments of comparison. Accelerated life testing. Analysis of variance. Correlation and regression.

*Industrial Engineering is a Department within the School of Mechanical and Industrial Engineering.

18.004 Manufacturing Management F L1T1

Prerequisites: 18.503, 18.603, 14.001, 14.002.

Production control: organisation, planning, modes of manufacture, information flow, demand forecasting, management systems, uncertainty. Quality control: sampling inspection, economic aspects, control charts, management of QC. Project control: critical path scheduling, PERT. Computers in manufacturing management: systems design.

18.011 Industrial Engineering IA F L1¼T¾

Prerequisite: 10.022. Co- or prerequisites: 5.071, 5.111 or 5.122.

Manufacturing Properties of Materials: Stress-strain curves to high strains, effects of strain-rate and temperature. Properties under hot and cold working. Combined stresses, yield criteria, introduction to plasticity theory. Friction effects in metal working, plane strain forging and rolling. *Metal Cutting Theory:* Mechanics of the process, effect of work-hardening, prediction of shear angle and cutting force. *Metal Cutting Tools:* Tool materials: plain carbon, alloy steel and sintered materials, hardening and heat treatment, T.T.T. curves. Tool wear, life and failure, tool performance. Surface finish. Machinability. Economics of machining. *Other Metal Removal Processes:* Electric-discharge machining, electrochemical machining.

18.012 Industrial Engineering IIA F L2T1

Prerequisites: 5.112 or 5.123, 18.011.

Theory of Manufacturing Processes: Processes including extrusion, tube making, rolling, blanking and piercing, sheet metal forming and deep drawing, oblique machining and application to practical tools. Machine tool design and utilization. Static and dynamic response of machine tools systems and effect on workpiece accuracy.

Technology of Manufacturing Processes: Selection of processes and machine tools to achieve the design requirements for a product. Functional and economic analysis of various conventional and computer-numerically-controlled (CNC) processes in relation to design. Product analysis project. Analysis of manufacturing processes and methods of assembly of selected products.

18.020* Industrial Orientation S2 L1T0

A series of lectures and discussions designed to prepare students for Industrial Training. Topics include: Forms and structure of private and public organizations; line and staff; authority and responsibility; company objectives; functions of staff departments, eg personnel, purchasing, quality control, industrial engineering, accounting; new forms of organization. Industrial legislation, industrial relations, safe practices. Employer expectations of the trainee engineer, requirements for the Industrial Training Report. Introduction to the specialist streams of the Years 3 and 4.

18.021 Industrial Engineering IB F L1½T½

Prerequisite: 10.022. Co- or prerequisite: 5.071.

Engineering Economy: Price-output decisions under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their applications in the selection and replacement of processes and equipment. Construction and optimization of particular models, eg replacement, capital rationing. Measures of profitability. *Industrial Application of Probability:* Tutorial problems from the fields of sampling inspection, quality control, control charts — simple economic models, eg newsboy problem, length of steel bars.

18.022 Industrial Engineering IIB F L2T1

Prerequisites: 5.071, 18.021.

Design of Manufacturing Facilities: Product and objectives, equipment selection. Charting and systematic improvement of methods, factory and workplace layout, the factory environment. *The Use of Human and Physical Resources:* Motion and time study, financial incentives, applications to machine controlled processes. Work sampling and data collection, predetermined motion-time systems.

Industrial Psychology: Individual differences, operator selection and learning, motivation to work, conflict and frustration, social aspects of industry, worker participation.

Production Control: The detailed mechanics of control of jobbing production, and its extension to batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Application of data processing and control systems. Introduction to inventory control. Analysis of some engineering planning decisions. Sampling technques in quality control. Control charts. Further quantitative work.

18.204 Introduction to Automation I S1 or S2 L2T1

Overview of automation; comparison of mechanical, electronic and fluidic logic circuits; automation devices, eg feeders, manipulators, conveyors; introduction to digital logic and number systems as they affect automation design; systems design.

18.214 Introduction to Automation II S1 or S2 L2T1

Prerequisite: 18.204.

Introduction to the use of specific logic devices with particular reference to electronic integrated circuits; the use of microprocessors as logic devices; comparison of hardware and software logic; detailed design of simple automation systems.

18.224 Numerical Control of Machine Tools S1 or S2 L2T1

Overview of numerical control systems; machine specification and selection; manual part programming; production and operator aspects including selection of operating conditions, work holding devices and tooling; introduction to computer assisted programming.

18.303 Methods Engineering F L1T1

Prerequisites: 5.072, 18.020.

Aims: Historical development, measurement of productivity.

Methods study: motion economy, ergonomics, man-machine relationships.

Factory environment: layout, conditions, safety.

Work measurement: purposes, time study, fatigue, human work capacity, predetermined motion time systems, regression methods, work sampling.

Human factors: motivation to work, job satisfaction, socio-technical systems, incentive plans.

Laboratory: exercises in work measurement, workplace design, ergonomics.

18.403 Production Design and Technology F L2T2

Prerequisites: 5.072, 5.422 or 5.411 and 8.259.

Basic metrology and tolerancing; introduction to plasticity theory and its application to theories for machining and forming; economics of production processes; interaction of machines and tools; principles of process selection; review of major processes; interaction of design, production quantity, materials and processes; value analysis.

18.404 Design for Production F L1T1

Prerequisite: 18.413.

Overview of design for production and its relation to overall design process; selection, specification and interpretation of tolerances; process selection; analysis of various production processes; jig, fixture and gauge design.

18.413 Design for Industrial Engineers S1 L1T1 S2 L1T2

Prerequisites: 5.122 or 5.123, 5.422 or 5.411 and 8.259.

Session 1: Industrial design. Tooling design. Production aids. Fluid power systems. Introduction to fatigue in design.

Session 2: (Common with Session 2 in 5.123 Mechanical Engineering Design III.) More advanced design analyses, component design and drawing with individual and group projects of an interdisciplinary nature.

18.431 Design for Production F L1T2

Prerequisite: 5.112.

General method for geometric analysis of engineering designs. Analysis for various interchangeability policies; selective assembly, unit assembly, application of probability theory. Geometry tolerancing; interpretation, datum systems, analysis, standard presentation, grouping. Economics of tolerance allocation. Process capability; relationship between process capabilities and product requirements. Principles of gauging and gauge design; production datum systems and their relation to function datum systems, effect of jig, fixture and gauge tolerances on product function. Metrology; measurement of size, form and position.

18.432 Design of Production Systems F L2T4 (Project)

Prerequisites: 5.071, 18.011, 18.021.

This subject may be taken only by part-time students in their final year.

Interchangeable Manufacture: Design for production, tooling, gauges, metrology.

Process Selection: Evaluation of alternative processes, make or buy decisions, planning the process sequence, case studies.

Production Planning: Forecasts, capacity decisions plant location, factory design and layout.

Production Systems: Computer systems for production control and information flow, computer control of machines and groups of machines, socio-technical systems.

Project: The project will consist of the design analysis for production and the planning of the production system for the manufacture of a simple engineering assembly. A comprehensive written report will be required.

18.503 Operations Research A F L2T1

Prerequisites: 5.072, 10.022. Co-requisite: 18.803.

History and overview of operations research. Decision theory. Methodology: identification and formulation of the problem; construction of a model; obtaining solutions; testing the model and implementing the solution. Case study.

18.551 Operations Research F L2T1

Prerequisites: Either 5.071 and 18.021 or 10.031, 10.331 and 18.121.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models; simulation. These techniques applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

18.603 Management/Economics F L1T1

Prerequisites: 5.072, 18.020.

Introduction: objectives of a company, measures of performance, need for economic decisions.

Cost information: sources of costs, fixed and variable, overheads, break-even analysis.

Engineering economics: time value of money. Derivation and use of interest formulae. Evaluation of alternatives, annual and present equivalents, D.C.F. rate of return. The minimum acceptable rate of return. Capital budgeting. Replacement studies. Risk and uncertainty.

Management: historical background. Industrial psychology, motivation, frustration and conflict. Industrial relations, union and arbitration structures. Industrial and commercial law, liability of employers, contracts, trade practices, patents. Marketing, sales forecasting, advertising ethics.

18.803 Optimization **S1 L2T1**

Prerequisite: 10.022. Co-requisite: 18.503.

Optimization in one dimension. Conditions for optimality in dimensions. Linear programming: problem formulation, solution by the simplex method, duality and post optimality analysis. The transportation algorithm. Dynamic programming. Unconstrained and linearly constrained non-linear programming. Geometric programming.

Servicing Subjects

18.121 Production Management **F L3T0**

18.131 Operations Research

Graduate Study

18.061G Industrial Experimentation I **C3**

Design of experiments with reference to industrial problems; planning experiments; significance testing; simple comparative experiments, accelerated experiments; fatigue testing, tool life testing; economic aspects of experimental design; analysis of variance of randomized block, latin square and factorial experiment designs.

18.062G Industrial Experimentation II **C3**

Regression analysis; use of orthogonal polynomials in regression analysis and analysis of variance; confounding in factorial design; response surfaces and determination of optimum conditions.

18.073G Ergonomics **C2**

The application of ergonomics to work and industry. Applied anatomy and kinesiology leading to work place arrangements. Anthropometry and work place dimensions, seating, individual differences. Physiological and psychological aspects of work and fatigue. Environmental considerations: thermal, noise, lighting. Perception, displays and machine controls. Safety considerations.

18.074G Industrial Management **C3**

Technical aspects: objectives of an enterprise or organisation,measures of overall performance, interfirm comparisons; monitoring performance, feedback and control, use of quality and inventory control, work study, accounting reports; corporate planning, use of forecasts, market surveys, operations research.

Organisational aspects: organisational structures, defining authority and responsibility; communication in organisations, information systems; the personnel function, selection, training and development, appraisal.

Human aspects: changing management styles, influences of ownership, technology, social attitudes, composition of the workforce, company size, organised labour; psychological factors, motivation, conflict situations, job satisfaction, leadership, adapting to change; industrial relations, trade unions and arbitration system structures, problems and cases; industrial democracy, participation in ownership and management.

18.080G Organization and Administration **C2**

The development of the theory and practice of organization in industry. The nature and types of organizations. The application of the principles of organization in the design of organizational structures.

18.083G Industrial Studies **C2**

Studies in the organizational and executive action requirements of certain specific industrial situations, using the case study method. Members of the class are required to make formal verbal presentation of solutions.

18.084G Industrial Applications of Probability Theory **C4**

Probability and Statistics: An introduction to probability theory. Random variables and distribution functions. The Binomial, Poisson and Normal distributions in particular. Standard sampling distributions, including X^2, t and F. Estimation by moments and maximum likelihood. Confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data. *Industrial Applications:* Tutorial problems from the fields of sampling inspection, quality control, control charts. Simple economic models — for example, the newsboy problem, length of steel bars.

18.171G Inspection and Quality Control **C3**

Economics of measurement; advanced measuring and inspection methods; non-destructive testing; quality control systems; sampling by attributes and variables; standardization; case studies; process capability and variability; machine tools acceptance testing; alignment procedures.

18.260G Computer Aided Programming for Numerical Control **C3**

Brief review of N.C. systems and manual programming. Requirements of a high level language designed specifically for programming N.C. machine tools. Languages available and their use on mainframe, mini or

micro computers, eg APT, ADAPT, FANAPT, UNIAPT, MICRO APT, etc. Detailed study of the structure and use of 'Automatic Programmed Tools' (APT) language including overview of language, basic APT grammar, part program structure, geometry statements, motion statements, macro commands, postprocessors, diagnostics.

18.261G Computer Automation C3

Computer architecture including central processer, random-access memory, read only memory, input/output ports, peripherals, and the relationships between each. A systematic study of the requirements for interfacing computers to the real world. Machine code, assembly language, and high level languages such as BASIC or FORTRAN with a comparison of each for particular applications. Development of small computer system for machine tool control, automated inspection, supervision, stock control, etc.

18.262G Economics of Machining for Automation C3

Estimation of power consumption in turning, milling, contouring, etc. Economics of machining including the following cases: **1.** constant feed no constraint; **2.** machining with power and feed constraint; **3.** estimating costs to allow for variability; **4.** influence of tool and plant costs; **5.** selection of production rate to suit various criteria. Introduction to tool materials and tooling, tool materials — selection and grading, throwaway tooling, preset tooling, tool setting devices, principles of tool design.

18.271G Theory of Machine and Forming Processes C3

Plasticity Theory: Approximate methods of solution including upper bound; slip line field theory. *Manufacturing Properties of Materials:* Influence of strain, strain rate and temperature on flow stress. *Analysis of Forming Processes:* Application of theoretical methods; solutions for ideal and work hardening materials. *Analysis of Machining Processes:* Orthogonal and oblique machining theories; application to drills and mutli-point tools; prediction of cutting forces, temperature, stresses.

18.272G Technology of Machining and Forming Processes C3

Selected topics from: Machine tool vibration; designs of machine tool elements; economics of machining and forming; numerical and adaptive control of machine tools; design of dies and cutting tools for strength and wear resistance; automation.

18.370G Design of Work Systems C3

Historical review: Selection and organisation of workforces throughout history, effects of technology, use of deprived groups, characteristics and aspirations of the modern workforce. *The physical workplace:* Applications of ergonomics to workplace and handtool design. Control of the environment, safety and health considerations, lesiglation and other influences. *Planning work loads:* Estimating times for tasks, allocation of work among groups, assembly work by fixed position or by production line. Production line balancing. Group technology systems. Avoiding or allowing for fatigue. *Interaction with machines:* Machine-controlled processes, machine interference, queueing, optimisation of the man-machine system. *Interaction with others:* Co-ordination of work within groups, critical path scheduling; workplace arrangements to foster communication and avoid isolation. *Quality of work life:* Job enrichment and job enlargement. Worker participation in planning. Autonomous work groups and socio-technical systems. Trends towards industrial democracy.

18.371G Factory Design and Layout C3

Production Requirements: Processes, machines and storage; optimum factory size, multiple factories. *Plant Location:* Single and multiple factories and warehouses; location models and economic analysis. *Factory Design:* Function; appearance; economic factors; environmental factors. *Materials Handling Systems:* Influence on layout; economic choice between alternatives; long-distance transport. *Layout Design:* By product: types of production line, means of line balancing, queueing theory applications. By process: travel charts and computer programs for optimization. Practical aspects; provision of services and amenities; layout visualization methods. A project forms a substantial proportion of the assessment for this subject.

18.380G Methods Engineering C4

Methods Study: History and objectives. Charting and systematic improvement of methods, factory and workplace layout. Physical and social aspects of working conditions. *Work Measurement:* Defining and using 'standard times'. Time study techniques and problems, predetermined motion-time systems, work sampling, standard data and formulae. Accuracy and statistical testing of data. *Industrial Psychology:* Motivation to work, frustration and conflict in industry, sources of job satisfaction. Financial incentive schemes, job enrichment and worker participation.

18.461G Design for Production C4

Influence of manufacturing processes on design; design simplication and standardization; value engineering; economics of process selection; case studies.

18.462G Industrial Design C2

Economic considerations; fundamentals of design; influence of processes; case studies.

18.463G Tool Design C4

Advanced theories and techniques for design and specification of cutting tools; jig and fixture design; press tool design, gauge design; design of selected machine tool components; computer aided tool design.

18.464G Value Analysis/Engineering C3

Cost reduction through value analysis/engineering illustrated by case studies. Selection of projects to be studied, collection of information, creative problem solving, development of alternatives, functional analysis system technique, functional evaluation, cost-function relationship, decision making, communication and implementation of the proposal. Applications to engineering design and services.

18.471G Design Communication C2

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

18.472G Engineering Design Analysis C6

Further development of techniques for geometric analysis of engineering designs; application of probability to tolerance summations in general; economic tolerance selections. Fundamental features of jigs, fixtures and cutting tools, their design and tolerancing. Principles of gauging and application to gauge design including gauges for positional and other complex work. Case studies.

18.571G Operations Research I C6

The formulation and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models and simulation. These techniques are applied to situations drawn from industrial fields, for example, production planning and control. Practical problems of data collection, problem formulation and analysis.

18.574G Operations Research II C3

Problem definition. Principles of model building. Participation in an operational simulation. Construction of decision rules. Operations. Research case studies and seminars.

18.579G Case Studies in Operations Research C3

Problems confronting management are seldom in the form of clear cut textbook type exercises; rather they are often ill-structured and ambiguous. A variety of such problems in operations research/ management science is considered with emphasis on the common pitfalls that arise in solving real world problems and the comparison of different strategies for solution. Students are expected to prepare written reports on certain cases considered suitable for submission to management.

18.580G Operations Research C6

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models; simulation. These techniques applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

18.671G Decision Theory C2

Theories of choice, value, risk and uncertainty for the individual and for multi-person situations. Statistical decision theory. Bayes and minimax rules.

18.675G Economic Decisions in Industrial Management C3

General aspects: the economic objective, the single-period investor's model, economic criteria, the mathematics of finance.
Deterministic models: project evaluation using discounted cash flow analysis; capital structure; debt and equity financing; cost of capital and the minimum acceptable rate of return; taxation; inflation and its effects.
Probabilistic models: multiple objectives and multi-attribute value systems based on means and variances of cash flows.
Particular applications of economic decision-making: venture and risk analysis, risk management, static and dynamic replacement models, rent-or-buy decisions, breakeven analysis, expansion and economic package concepts, analysis of projects with public financing.

18.680G Decision Making under Uncertainty C2

The structure of decisions: payoff matrices, decision trees. Principles of choice; utility of risky choice; subjective probability. Analysis of decisions under risk; certainty equivalents; value of imperfect information. Bayesian criteria of choice of their application to solving realistic problems.

18.681G Engineering Economic Analysis C3

Price-output decisions under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their application in the selection and replacement of processes and equipment. Construction and optimization of particular models, eg replacement, capital rationing. Measures of profitability.

18.761G Simulation in Operations Research C3

The relationship of simulation to other methods of comparing alternative solutions to industrial problems. Computer simulation languages. Process generation. Variance reduction techniques. Analysis of simulation generated time series. Formulation and construction of models for simulation. Problems of simulation. Design of simulation experiments. Optimization through simulation. Examples of the use of simulation. Heuristics.

18.763G Variational Methods in Operations Research C2

The variational problem and its history. The modern formulations. Mathematical Theory. Application to a wide range of problem areas such as production and inventory control, advertising, machine maintenance and natural resource utilization.

18.764G Management of Distribution Systems C2

Prerequisite: 18.503.

The distribution system: single depot location, multi-depot location, vehicle scheduling, vehicle loading, fleet size, case studies.

18.765G Optimization of Networks C2

Prerequisite: 18.551.

Network representation of decision problems. Activity networks PERT-CPM, Euler and Hamiltonian paths, shortest path, maximum flow, multi-commodity flow, out-of-kilter algorithm, convex cost networks, stochastic cost networks — GERT.

18.770G Stochastic Control C2

Markov decision processes for finite and infinite planning horizons. Optimality criteria. Contraction mappings. Computational techniques. Optimal stopping. Semi-markov decision processes. Application to inventory, replacement and queues.

18.772G Information Processing Systems in Organizations C2

The place of operations research in information processing systems. Computer hardware and software. Data structures and data manipulation techniques. Typical structures of suites of programs. The life cycle of information processing systems. System design. Applications packages with emphasis on systems for production and inventory control. Major problems in information processing systems.

18.773G Optimal Control in Operations Research C2

Brief survey of dynamic optimization techniques. Introduction to the calculus of variations and the maximum principle for both continuous and discrete systems. Applications to operations research problems drawn from the areas of production and inventory control, machine maintenance, investment and natural resource utilization.

18.774G Applied Stochastic Processes C2

Examples of stochastic processes, basic concepts and Markov chains. Renewal theory. Applications to queues, inventory replacement, risk, business and marketing. Markov decision processes.

18.775G Networks and Graphs C2

Basic concepts. Application of Hamiltonian paths, Euler cycles, trees, planar graphs, dominating and independent sets to operations research problems. Shortest route algorithms. Concept of maximum flow in a network applied to transportation assignment and scheduling problems.

18.776G Production and Inventory Control C2

Basic inventory replenishment models, continuous stock review, periodic re-ordering and base stock models, with deterministic, probabilistic, and dynamic demands. Variations of the basic models to include additional features (eg demand dependent on delivery time). Costs of the complete system in practice. Production smoothing models. Forecasting techniques. Optimum stock locations in multistage systems. Practical inventory surveys and control systems.

18.777G Time Series Forecasting C2

Stationary series. Autoregression. Spectral analysis. Estimation of trends, seasonal effects and parameters. Exponential smoothing. Error analysis and tracking signal. Choice of method.

18.778G Scheduling and Sequencing C2

Criteria for evaluation schedules. Scheduling of single machines. Job-shop scheduling with two, three or more machines. Permutation schedules. Groups of machines. Scheduling constrained resources.

18.779G Game Theory C2

Two-person zero-sum games: the minimax theorem, relationship to linear programming. Two-person general-sum games. Non-co-operative and co-operative n-person games. Games without side payments. Economic market games.

18.780G Production Control C2

Corporate objectives and organization. The production environment. The detailed mechanics of control of jobbing production and its extension to repetition batch and continuous production. Manufacturing organization and controls, functions, inter-relationship and information flow. Relevance to computerized control. Introduction to inventory control, and the analysis of some typical engineering planning decisions.

18.862G Linear Programming C2

The revised simplex method. Sparse matrix techniques. Duality and postoptimality analysis. Extensions to the simplex method. Generalized upper bounding. Decomposition. Simplex-based nonlinear programming. Integer programming. Applications.

18.863G Nonlinear Programming C2

Single variable optimization. Search methods. Conjugate gradient and quasi-Newton methods. Methods for linear constraints. Extension to large-scale systems. Penalty function methods for nonlinear constraints. Lagrangian methods. Applications.

18.864G Applied Geometric Programming C2

Optimization concepts developed for function of polynomial form. Solution techniques for such problems. sensitivity of solution. Applications of geometric programming to problems from engineering and operations research.

18.871G Mathematics for Operations Research C2

Classical optimization techniques. Convexity. Kuhn-Tucker conditions. Search and gradient methods in one and several dimensions. Probabilistic models and their optimization. Curve fitting, correlation and regression.

18.874G Dynamic Programming **C2**

The principle of optimality. Structure and formulation of dynamic programming problems. One-dimensional deterministic and probabilistic sequential decisions. Approximations in function and policy space. Multidimensional problems, computational aspects. Applications to allocation problems, inventory theory, replacement.

18.875G Geometric Programming **C2**

The geometric programming theory is developed for convex and non-convex mathematical programs. The theory is applied to polynomial and posynomial programming. As projects actual polynomial and posynomial programs will be solved.

18.876G Advanced Mathematics for Operations Research **C2**

A survey of mathematical ideas which are of value in operations research. Topics will be selected from the following areas: set theory, real analysis, matrix theory, topology, function spaces, linear operator theory, inequalities, stability, complex analysis, convex analysis, distribution theory, group theory and measure-theoretic probability theory.

18.877G Large-scale Optimization **C2**

Overview of large-scale problems. Structure of problems: block diagonal, block triangular systems. Solution strategies. Model construction and data preparation. Practice: examples and applications.

18.878G Industrial Applications of Mathematical Programming **C2**

Problem formulation: profitability criteria, operating constraints. Conventions for large-scale matrix construction; list and table-processing, error-checking. Use of commercial systems: data organization, interpretation of output, ranging procedures. Examples from actual industrial studies.

18.879G Mathematical Programming Analysis **C3**

Co-requisites: 18.871G; Linear Programming section of 18.571G.

Methods for the analysis of mathematical programs. Analysis of the properties of linearity, separability, convexity, quasi-convexity and duality, providing the basis for the conversion of mathematical programs to potentially simpler formulations. Includes the areas of geometric programming, convex programming and quasi-convex programming.

18.909G Project **C9**

18.918G Research Project **C18**

18.936G Research Project **C36**

18.960G Seminar (Production Engineering) **C0**

19.865G Seminar (Industrial Management) **C0**

18.967G Advanced Topic in Production Engineering* **C2**

18.968G Advanced Topic in Production Engineering* **C2**

18.969G Advanced Topic in Production Engineering* **C2**

18.970G Seminar (Operations Research) **C0**

18.977G Advanced Topic in Operations Research* **C2**

18.978G Advanced Topic in Operations Research* **C2**

18.979G Advanced Topic in Operations Research* **C2**

Nuclear Engineering

Undergraduate Study

23.051 Nuclear Power Technology **F L2½T½**

Atomic nuclei, radioactivity, neutron reactions, fissile and fertile materials, nuclear conversion and breeding cycles, plutonium. Criticality requirements, heat removal, control and safety of nuclear reactors. The thermal, hydraulic and structural aspects of gas and liquid cooled thermal reactors and liqid metal cooled fast breeder reactors. The status of fusion research and development. The technology, safety, economics and environmental impact of nuclear fuel cycles, from mining, through enrichment, fabrication and burnup to waste disposal. Comparative assessment of nuclear, fossil and alternative energy systems in local and global contexts.

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

Graduate Study

Not all subjects are available in any one year.

23.013G Neutron Transport and Diffusion **S2 L2½T½ C3**

Neutron and nuclear reactions, the formation of neutron spectra in infinite multiplying media, transport and diffusion theories, and their application to the analysis of heterogeneous reactor lattices.

23.014G Fewgroup Reactor Theories **S2 L2½T½ C3**

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

23.015G Multigroup Reactor Theories **S2 L2½T½ C3**

A selection of topics from general reactor theory, variational principles, perturbation theory, and multigroup transport theory, for the general problem of three-dimensional fine scale neutron flux distribution analysis.

23.016G Neutron Kinetics and Reactor Dynamics **S1 L2½T½ C3**

The derivation and application of point reactor kinetic models to the study of macroscopic power reactor dynamics, stability and control, and the development of general space-time kinetic models.

23.023G Reactor Thermal Performance **S1 L2½T½ C3**

The processes of heat generation, conduction, heat transfer and heat and momentum transport in fluids, in relation to the thermal performance of reactor channels and cores.

23.024G Boiling and Two Phase Flow **S1 L2½T½ C3**

Subcooled and bulk boiling, boiling crises, and the special problems associated with the analysis of reactor channel and core performance under boiling and two-phase flow conditions.

23.025G Reactor Structural Mechanics **S1 L2½T½ C3**

A study of theoretical models and numerical techniques required for the analysis of mechanical and thermal stress, deformation, and failure modes of reactor core components and containment structures under high temperature, neutron and gamma irradiation.

23.026G Reactor Systems Analysis **S2 L2½T½ C3**

Nonlinear and linear system dynamics and stability theory applied to reactor processes and components, for the development and use of overall reactor and power system dynamics models.

23.027G Boiling Reactor Dynamics **S1 L2½T½**

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

23.028G Reactor Accident and Safety Analysis **S2 L2½T½ C3**

The mathematical modelling and computation of ideal and actual reactor accident histories, particularly for fluid cooled systems, and the application of probability theory to reactor hazard evaluation.

23.032G Mathematical Analysis and Computation **S1 L2½T½ C3**

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

23.033G Matrix Theory and Computation **S2 L2½T½ C3**

Matrix theory and matrix computations required for the numerical solution of problems in neutronics, fluid dynamics, structural mechanics, etc, arising in the analysis and prediction of nuclear power system performance.

23.034G Random Processes and Reactor Noise **S2 L2½T½ C3**

The mathematics of random processes applied to fluctuation phenomena in nuclear reactors, and the practical application of noise analysis techniques to reactor monitoring, control, and parameter estimation.

23.042G Nuclear Fuel and Energy Cycles **S1 L2½T½ C3**

The utilization of nuclear energy, the thermodynamics of nuclear power systems and applications, and the study of nuclear fuel cycles.

23.043G Nuclear Power Costing and Economics **S2 L2½T½ C3**

The principles of nuclear power cost estimation for various reactor types and applications, the comparative evaluation of nuclear power systems, and the problem of reactor strategy.

23.044G Nuclear Engineering Optimization **S2 L2½T½ C3**

The theory and application of function and functional minimization techniques to problems of design, control and operation of nuclear reactors and associated nuclear fuel supply complexes.

23.045G Uranium Enrichment Technology **S1 L2½T½ C3**

The theory and technology of uranium enrichment by the diffusion, ultra-centrifuge and nozzle processes; the economics of enrichment within the nuclear reactor fuel cycle, in relation to optimal reactor strategy and resources utilization.

23.909G Project **F C9**

23.918G Research Project **F C18**

23.936G Research Project **F C36**

Geography

Undergraduate Study

27.295 Physical Geography for Surveyors **S1 L2T2**

Fundamentals of physical geography. Landscapes of Australasia. Techniques of landscape appraisal. Laboratory classes to support the above, including map analysis, air photo interpretation and examination of soil properties. There is a compulsory one-day excursion.

Graduate Study

27.901G Geomorphology for Hydrologists **S2 L1½T1½**

Geomorphological controls in the initiation of drainage systems. Drainage networks as geomorphological systems. Types of drainage channel. River floodplains and terraces. Drainage systems of arid regions. Geomorphology of representative basics and vigil catchments. Geomorphology in the assessment of water resources. Landforms produced by underground water. Airphoto and map analysis of drainage features and map and field study of a vigil catchment.

Surveying

Undergraduate Study

Note: Electronic Calculators.

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

29.001 Surveying I **S1 L3T1½**

Introduction to computations: principles, use of calculation aids, solution of triangles, areas of plane figures, co-ordinate systems, units of measurement. Introduction to surveying: principles, types of errors, computation of mean and standard deviation. Minor instruments: prismatic compass, clinometers, plane table alidades. Methods of distance measurement: tape measurements, corrections to tape measurements. Angular measurements: construction of theodolite, observation methods for direction and zenith distance measurement.

29.002 Surveying II **S2 L2T3**

Traversing: fieldwork, computation and adjustment. Principles of levelling, levels and associated equipment, field and reduction procedures, testing and adjustment of levels. Vertical staff tacheometry: principles, field and reduction procedures for stadia, self-reducing tacheometers. Survey methods for detail and contour surveys.

29.003 Surveying III **S1 L2½T2½**

Prerequisites: 29.001, 29.002. Co-requisite: 29.151.

Control surveys, orders of control, Integrated Survey Grid, methods of establishing control, practical considerations. Trigonometrical heighting, observation and reduction procedures. Barometric heighting, principles, field and reduction methods. Introduction to electronic distance measurement. Optical distance measurement. Introduction to single second theodolites.

29.004 Surveying IV **S2 L2T2½**

Co-requisites: 29.003, 29.151.

Setting out surveys. Calculation and setting out of horizontal circular curves and transition curves. Principles and calculation of vertical curves, sight distance. Determination of areas of irregular figures, trapezoidal and Simpson's rules. Volume determination from spot heights, contours and cross-sections, mass haul diagrams. Route surveys for roads, railways, waterways, pipe and transmission lines. Adjustments of theodolite and level.

29.005 Surveying V — S1 L3T2

Prerequisite: 29.003.

Electronic distance measurement principles, applications and instruments, propagation of electromagnetic waves, meteorological and geometric corrections, field procedures, instrumental errors and their calibration. Calibration of linear scales. Precise angle measurement, observations and reduction procedures, sources of error and their testing.

29.006 Surveying VI — S2 L2T1

Prerequisite: 29.003.

Error theory, expression of uncertainty, testing of observations, applications to design and analysis of surveys. Precise levelling; equipment, field procedures. Project surveys, integrated surveys, surveys for large structures, precise surveys for deformation, measurement and setting out machinery, mining and tunnel surveys, hydrographic surveys.

29.031 Electronic Distance Measurement — S2 L2T1

Prerequisite: 29.005.

Short range instruments: sources of error, field and computational methods of calibration, baseline design. Long range instruments: laser and microwave distance meters, sources of error, calibration, precise measurement techniques, geometric and atmospheric corrections. Properties of reflectors. Power sources.

29.032 Precise Surveys in Industry and Engineering — S2 L2T1

Prerequisite: 29.006.

Review of survey problems in industry and engineering. Setting-out of large structures: network design, measurements, methods of height transfer, optical plumbing, examples and accuracy requirements. Surveys for measurement of deformation and settlement: design of control network and stations, observation and adjustment techniques, detection of movement, electric measurement of small changes in length, height and inclination. Close-range indoor surveys: optical tooling, special equipment and techniques, auto-collimation, laser interferometry.

29.033 Characteristics of Modern Theodolites and Levels — S2 L2T1

Prerequisites: 29.006.

Construction features, sources of error and methods of testing modern optical surveying instruments. Topics selected from: circle and micrometer graduation errors, coded circles, calibration and behaviour of bubbles, automatic compensator systems, axis wobble, temperature effects.

29.034 Mine Surveying — S1 L2T1

Prerequisite: 29.006.

Statutory regulations. Mine plans and computations in three dimensions. Bore hole surveys. Surface and underground surveys. Transfer of azimuth, shaft plumbing and levelling Subsidence surveys. Gyrotheodolite. Specialized equipment and techniques.

29.035 History of Surveying — S2 L1T2

Historical development of geodesy, astronomy, cartography, photogrammetry, and geophysics. History of general surveying: mathematical aids, optics, instruments, electronic aids for surveyors. Selected topics from history of surveying and land law in Australia.

29.121 Electronics for Surveyors — S2 L1T1

Prerequisite: 1.971.

Linear circuits and systems, active circuit elements. Test instruments and electronic measurements. Digital circuits and systems. Data transmissions, recording and display. Systems evaluation.

29.151 Survey Computations I — S1 L2T2

Calculation of areas. Calculations for subdivisions, roadways and curves. Traverse computations including offsets and missing data. Transformations. Spherical trigonometry and its application to survey problems. Resection and intersection: unique and redundant solutions. Computer programming applied to surveying.

29.152 Survey Computations II — S1 L2T2

Prerequisite: 29.151.

Review of matrix algebra. General law of propagation of variances, variance factor, statistical testing, error ellipses for points and lines.

Adjustment by least squares: **1.** parametric method; **2.** condition method. Solution and inversion of normal equations.

29.153 Adjustment of Control Surveys — S2 L1½T1½

Prerequisite: 29.212.

Adjustment of control surveys on the ellipsoid. Statistical evaluation of the adjustment. Detection of outliers. Design and optimization of networks. Requires use of School computer program library.

29.161 Hydrographic Surveying I — S1 L3

Prerequisite: 29.006.

Introduction, theory of echo sounder, sounding techniques, visual fixing, electronic position fixing, tides, tidal streams, tidal datums, ocean currents, acoustic and wire sweeps.

29.162 Hydrographic Surveying II — S2 L0T3

Prerequisite: 29.161.

Practical training: undertake a hydrographic survey requiring establishment of horizontal and vertical shore control, preparation of plotting sheets, control marking, bathymetry, equipment calibration, tidal observations and reductions, inking in. Static display of other equipment. Lectures on nature of seabed, wind waves, the survey report. Discussions on practical surveying tasks or topics of current interest. A harmonic analysis of 12 days of tidal data.

29.173 Project — S1 or S2 L0T3

Prerequisite: High standard in the chosen topic area normally required; permission of project supervisor.

Theoretical or practical investigation of a selected topic under the guidance of a supervisor, with a report of a high academic standard required. Topic may be one suggested by the School or by the individual student based on his experiences.

29.174 Major Project — F L0T3 or S2 L0T6

Prerequisite: High standard in the chosen topic area normally required; permission of project supervisor.

An elective subject involving a detailed investigation of a selected or assigned topic under the guidance of a supervisor, with a report of a high academic standard required. Topic may be one suggested by the School or by the individual student based on his experiences.

29.191 Survey Camp I

Co-requisites: 29.001, 29.002.

A one-week field camp equivalent to 42 contact hours. A series of field surveying tasks designed to consolidate the current year's work and serve as an introduction to the following year's work. Tasks include traversing, levelling, stadia and detail survey measurements for the production of a large-scale plan. Calculations, preparation of plans and reports.

29.192 Survey Camp II

Prerequisite: 29.191. Co-requisite: 29.003, 29.004, 29.151.

A one-week field camp equivalent to 42 contact hours. A series of field surveying tasks designed to consolidate the current year's work and serve as an introduction to the following year's work. Surveys for the design of a road alignment, determination of dam capacity and methods of point fixation. Calculations, preparation of plans and reports.

29.195 Survey Camp III

Prerequisite: 29.192. Co-requisites: 29.005, 29.006, 29.511, 29.211, 29.311, 29.152, 29.661, 29.662.

A two-week field camp equivalent to 84 contact hours. Survey projects designed to consolidate course work. Field astronomy, triangulation, trigonometric levelling, photogrammetric control and cadastral survey.

29.196 Survey Camp IV

Co-requisite: 29.195.

Two weeks of office computations equivalent to 84 contact hours. Preparation of comprehensive individual reports based on field survey tasks completed in Survey Camp III.

29.211 Geodesy I — S2 L3T1

Historical development of geodesy. Goals of contemporary geodesy. The nature of the earth's interior. The earth's gravity field. Natural, geodetic, rectangular, and plane co-ordinates. Definition of and computations in geodetic reference co-ordinate systems. Review of transverse cylindrical projections. Transverse Mercator projections used in Australia. Scale factor and arc-to-chord corrections on the Transverse Mercator projection.

29.212 Geodesy II — S1 L2T1

Prerequisite: 29.211.

Principles of physical geodesy. Satellite applications in gravity determination. Principles of doppler, laser ranging to satellites and the moon, and very long base-line interferometry. Geodynamic applications. Methods of establishing a world geodetic system. Adjustment of control surveys using the condition and parametric methods of least square adjustment for measured angular and linear quantities. The role of the variance-covariance matrix, variance factors and the weight coefficient matrix. Elementary testing of observations and adjusted values.

29.213 Geodesy III — S2 L3

Prerequisite: 29.212.

Topics from: Time variation of geodetic position. Long-term goals of geodesy. Extension of the earth's gravity field into unsurveyed regions. The earth's variable rotation. Atmospheric refraction and its effect on survey measurement. Calculations on the ellipsoid. The conformal projection of the ellipsoid.

29.231 Geophysics for Surveyors — S2 L2T1

Interrelationship of geodesy and geophysics. The earth as a celestial body. Rotation and figure of the earth. Earth's interior. Principles of seismology, geohydrology, physical oceanography, tectonophysics, physics of atmospheric processes. Interrelationship of surveying and applied geophysics. Methods of geophysical exploration. Engineering and mining geophysics. Physics of mass movements.

29.232 Atmospheric Effects on Geodetic Measurements — S2 L3

Development of refraction theory. Wave propagation in an inhomogeneous medium. Refractive properties of air. Principles of thermodynamics of gases, boundary and surface layer meteorology, structure of atmospheric turbulence. Meteorological meausurements. Electromagnetic wave propagation in a turbulent medium.

29.311 Astronomy I — S2 L2T1

Uses of field astronomy. The solar system, the celestial sphere and the astronomical triangle. Time systems and time keeping. Latitude by circum-meridian and longitude by extra meridian methods. Prediction of observation programs. Evaluation of precision of results. Introduction to the determination of azimuth.

29.312 Astronomy II — S1 L1½T½

Prerequisite: 29.311.

Determination of azimuth from circum polar, circum-elongation and sun observations. Simultaneous determination of latitude and longitude by the position line method. Prediction of observation programs. Evaluation of precision of results.

29.313 Astronomy III — S2 L2T1

Prerequisite: 29.312.

Topics selected from: geodetic astronomical methods, daylight star observations, meridian and equal altitude methods, variation in star co-ordinates, sun dials, celestial methods in navigation.

29.441 Surveying for Engineers — S1 or S2 L2T4

Co-ordinate Systems. Levelling. Theodolite and angular measurements. Distance measurements: steel band, electronic. Traversing. Tacheometry. Contour and detail surveys. Horizontal and vertical curves. Area and volume computations. Control, engineering and underground surveys. Outline of photogrammetry.

29.491 Survey Camp

A one-week field camp.

29.511 Photogrammetry I — S2 L2½T1½

Prerequisite: 29.151.

Photographic geometry, relief and tilt effects. Interior orientation. Stereoscopic vision, parallax and height. Collinearity equations and deviations from collinearity encountered in practice. Space resection. Relative orientation: concept, procedure, error effects. Ground control selection and absolute orientation. Stereoplotter principles.

29.512 Photogrammetry II — S1 L2T1

Prerequisite: 29.511.

Review of relative and absolute orientation. Plotting, map compilation, relief representation, map reproduction. Map revision, radial line mapping from a single photo pair. Orthophotos and mosaics. Introduction to photogrammetric control extension, use of auxiliary data. Project planning: costs, scheduling, specifications, photogrammetric production capabilities and limitations. Non-topographic photogrammetry. Analytical methods.

29.513 Photogrammetry III — S2 L2½T½

Prerequisite: 29.512.

Review of inner, relative and absolute orientation. Aerial triangulation: analogue continuous strip methods, method of independent models, analytical methods, block adjustments, accuracies, error propagation. Use of auxiliary data. Problems associated with solutions of large systems of equations. Camera calibration. Non-topographic applications.

29.514 Principles of Remote Sensing — S1 L2T1

Brief history. Electromagnetic radiation. Definition and physics of basic quantities. Photographic film images and sensors. Electro-optical sensors. Microwave images and sensors. Data systems — ground truth, calibration, sampling, transmission, storage, retrieval, classification enchancement, restoration. Positioning considerations. Examples of operational systems.

29.631 Land Inventory I — S2 L1T1

Land inventory surveys: role of surveyors, general procedures. Photo interpretation techniques, aerial photographs and their use and application. Spatial, spectral and temporal variations. Elements of interpretation. Systematic interpretation methods. Sampling methods, the purpose of sampling, sampling procedures. Elementary statistics for areal sampling. Classification systems. Reliability of mapped class boundaries. Integrated resource surveys; status of world mapping; concepts and specifications of integrated surveys. Thematic and parametric surveys.

29.632 Land Inventory II — S2 L2T1

Principles and types of spatial information systems. Land and its attributes. Geocoding: concept of a spatial identifier; external index, topological, co-ordinate. Examples of polygon and segment oriented methods. Spatial searching. Use of digitizers. Examination of typical systems. Incorporation of remotely sensed data. Forms of presentation.

29.651 Land Development I — S1 L2T1

The surveyor's role in land development. Variation of land use and land value and its effect on land development. Urbanization and land use. Location theory in urban areas. Public measures for directing land use. Social, economic and locational determinants of land use. Land on the urban fringe. Introduction to valuation. Factors affecting the value and valuation of land. Valuation principles for land use and subdivision.

29.652 Land Development II **S2 L2T1**

Subdivision control in NSW. Broad-acre subdivisions under the Local Government Act, 1919. Procedures and legal controls. Review of subdivision design. Engineering aspects.

29.653 Land Development III **S1 L1T2**

Prerequisite: 29.652.

Design and studio project for a neighbourhood development. Constraint and site analysis: preparation of maps for land use and vegetation, surface and soils, drainage and terrain, slopes, climate and aspect, composite maps. Structure plan: residential precincts, schools, commercial areas, industrial areas, active and passive recreation, pedestrian ways and road hierarchy. Plan of detailed lot layout: consideration of access, grades, drainage, drainage reserves, parks, and pedestrian ways. Engineering design and plans: catchment details, longitudinal and cross-sections, drainage layout and longitudinal sections, flow schedule with calculations, longitudinal sections of kerb profiles.

29.654 Land Development IV **S2 L2T1**

Prerequisite: 29.653.

Detailed study of the land development process. Role of local government. Alternative design concepts. Environmental problems associated with land development. Environmental impact statements, theory and methodology. Legal aspects and authorities. Economics as a constraint on development, costs, ranking of investment proposals. Application of quantitative management methods to staging and analysis of development projects.

29.661 Cadastral Surveying and Land Law I **S1 L1½T½**

The legal system in NSW as it affects the land surveyor. Forms of titles: Old System titles, Torrens titles and Crown lands titles. Land law: legislation, real and personal property, interests and estates in land, riparian rights and conveyancing. The status of roads in NSW. Maritime law. The operation of the cadastre in NSW: an historical introduction, the role of the boundary surveyor and boundary control.

29.662 Cadastral Surveying and Land Law II **S2 L2T1**

Prerequisite: 29.661.

Practical and legal aspects of cadastral surveying in NSW including: survey and title searching; survey investigation; re-determination of artificial and natural boundaries; related statutes, regulations and case law; the preparation of plans for title surveys; and subdivisions under the Strata Titles Act, 1973 as amended.

29.663 Cadastral Surveying and Land Law III **S2 L2T1**

Prerequisite: 29.662.

The relationship between land information systems, title and deed registration, cadastral surveying and the cadastre. Forms and components of land tenure and cadastral systems. Aspects related to the definition of the cadastre: cadastral mapping, integrated surveys and methods of defining land parcels.

29.664 Modern Title Concepts **S2 L2T1**

Prerequisite: 29.662.

Past, present and future of group housing title concepts, Strata and cluster titles in NSW. Strata Titles Act, 1973. The development process related to group housing. Management of strata schemes. Feasibility studies for group housing.

29.700 Professional Orientation **S1 L1T½**

Introduction to the total field of surveying activities and their relationship to associated disciplines. Introduction to geodesy and position fixing from celestial bodies. Map projections and co-ordinates. Introduction to the use of aerial photographs. Maps and aerial photographs and their application to resource surveys. Role of consulting surveyor. Brief introduction to cadastral, engineering and land development surveys. Mining and hydrographic surveys. Includes a visit to several surveying establishments.

29.701 Seminar I **S2 L0T1**

Basic writing and speaking, introduction to the literature of the profession. Oral presentation by individual students on assigned topics in selected areas of surveying.

29.702 Seminar II **S1 L0T1**

Effective writing and speaking, increased emphasis on research of literature. Oral presentation by individual students on assigned topics in selected areas of surveying.

29.703 Seminar III **S2 L½T½**

Effective communication. Technical writing for comprehension. Additional speaking experiences. Invited speakers on current areas of interest in surveying. Student critique of course.

29.704 Management I **S1 L2T0**

Introduction to the social framework of business. Financial accounting methods and interpretation of financial statements. Finance and financial planning with emphasis on projects and small business. General management functions. Introduction to quantitative manage-ment methods and their application.

29.705 Management II **S2 L2T0**

Professional responsibilities, legal aspects of professional practice. Principles of management and organization. Management functions. Quantative management methods. Project planning. Introduction to cost benefit analysis. Project and office management.

29.800 Survey Draughting **S1 L½T2½**

Fundamentals of survey draughting. Abbreviations, symbols, sizes of drawing sheets, layout of drawing sheets, lines, letters, numerals, scales, projection and sectioning, dimensioning, architectural drawing, engineering survey and design drawings.

Mapping signs and symbols recommended by the National Mapping Council. Drawing practice in boundary surveying. State regulations.

29.801 Cartography I **S2 L1½T1½**

Mathematical cartography, principles of map projections, characteristics of surveying projections and grids: Universal Transverse Mercator, Australian Map Grid, Integrated Survey Grid. Topographic cartography, representation of features, toponymy, map series, cartometry. Thematic cartography concepts. History of cartography.

29.802 Cartography II **S1 L1½T1½**

Cartographic technology: characteristics of base materials, drawing techniques, scribing techniques, symbol and type preparation, photomechanical methods, screens and masks, colour registration, proofing methods, principles of lithography. Planning, costing and organizing cartographic work.

29.803 Mapping Technology **S2 L1½T1½**

Prerequisite: 29.512.

Production of base maps from aerial photographs, rectification theory, photographic mosaics, differential rectification and orthophotomaps, cartographic completion of photomaps. Automation of cartographic processes, data collection and processing, plotting software and hardware, digital terrain models.

Servicing Subjects

29.411 Surveying for Architects and Builders **S1 L1T1½**

29.901 Introduction to Mapping **S1 L1T½**

Graduate Study

29.101G Aspects of Electromagnetic Distance Measurement **SS L2T1 C3**

New developments in electronic distance measurement instruments including multiple wavelength systems, interferometers, optical transponders. Component properties of instrumental errors. Techniques of instrumental calibration and establishment of calibration facilities. High precision measurement techniques.

29.102G Characteristics of Optical Surveying Instrumentation **SS L2T1 C3**

Sources of error in modern optical surveying instruments. Methods of testing and calibration. Observational techniques for reducing effects of errors. Developments in circle reading and level sensing systems. Design of instrument testing facilities.

29.103G Precise Engineering Surveys **SS L2T1 C3**

Techniques and instrumentation for precise surveys. Applications in industry and engineering: deformation and settlement surveys, surveys for large constructions, optical tooling, special measurement problems.

29.106G Special Topic in Surveying A **C3**

A special subject to be lectured on by visiting professors or other visiting staff. Details of syllabus and lecturer to be communicated to the Higher Degree Committee on each occasion when the subject runs.

29.107G Special Topic in Surveying B **C3**

A special subject taken by an individual student or a small group of students by private study in conjunction with tutorial sessions with the member(s) of staff in charge of the subject.

29.151G Adjustment of Observations **SS L2T1 C3**

Choice and analysis of adjustment models in geodetic triangulation and control surveys. Detection of outliers. Design optimisation and analysis of survey control networks. Methods of carrying out very large continental adjustments.

29.171G Mathematical Methods I — Numerical Analysis **SS L2T1 C3**

Topics from real analysis, computational error theory, curve fitting by orthogonal polynomials, trigonometrical and exponential series, time series and quadrature.

29.172G Mathematical Methods II — Statistical Theory of Survey Observations **SS L2T1 C3**

Advanced application to survey observations of frequency distributions, moments, minimum variance, unbiased estimation, central limit theorem, analysis of variance and statistical testing. Outlying observations.

29.173G Mathematical Methods III — Spherical Harmonics **SS L2T1 C3**

Two dimensional Fourier Series. Theorems of vector field theory. The solution of Laplace's equation in spherical coordinates. Spherical harmonics.

29.174G Mathematical Methods IV — Theory of Survey Adjustment **SS L2T1 C3**

Matrices, multivariate normal, distribution of quadratic forms, five standard problems of Tienstra, geometrical interpretation of Least squares adjustment, free net adjustment and generalised matrix algebra. Solution of large sets of equations. Confidence ellipses.

29.175G Mathematical Methods V — Collocation **SS L2T1 C3**

Fundamental assumptions. The covariance function and its modelling. The solution and theoretical accuracy. Interpolation, filtering, prediction and transformation by collocation. Applications in physical geodesy.

29.201G Geodetic Methods **SS L2T1 C3**

Basic Concepts: Motion of the earth in space. Reference coordinate systems. Geodetic boundary value problem. *Terrestrial Techniques:* Horizontal control. Vertical control. Three-dimensional control, variation with time. Polar motion and rotation. Gravity. *Space Techniques:* Worldwide and regional determination of positions. Global gravity measurements. Earth rotation, polar motion and tidal dissipation. Lunar and planetary geodesy.

29.202G Solid Earth, Ocean, Lunar and Planetary Geodesy **SS L2T1 C3**

Geodynamics: Tectonic deformation. Response of the solid earth to external effects. Gravity. Earth rotation and polar motion. *Ocean Dynamics:* Surface ocean circulation and tides. Mean sea surface. Time varying sea surface. *Moon and Planets:* Physics of the moon and planets.

29.203G Gravimetric Geodesy **SS L2T1 C3**

General principles of gravimetric geodesy. Data requirements. Gravity field extension techniques. Combination of satellite and surface gravity data. Gravitational field of the rotating ellipsoid. Fundamental equations for the solution of the boundary value problem, solutions of geoid-ellipsoid separation and deflections of the vertical to the order of the earth's flattening. Comparisons of astrogeodetic and gravimetric solutions.

29.204G Geodetic Refraction **SS L2T1 C3**

Mathematical refraction theory: Electromagnetic wave propagation in an inhomogeneous and turbulent medium. Refractive properties of the atmosphere. *Principles of atmospheric models:* Boundary and surface layer meteorology. Structure of atmospheric turbulence. *Atmospheric effects:* Nature, instrumental solution and models of atmospheric effects on terrestrial and extraterrestrial geodetic measurements. Accuracy and precision requirements.

29.205G Geodetic Analysis Techniques **SS L2T1 C3**

Orbital motion of earth's satellites, analysis of satellite orbits for low-degree harmonics of earth's gravitational field. Principles of data reduction of Doppler position systems, satellite laser ranging, long base-line interferometry and satellite altimetry.

29.206G Advanced Geodetic Instrumentation **SS L2T1 C3**

Terrestrial instrumentation: Electronic distance measuring instruments. Strainmeters. Tiltmeters. Optical-angle measurement instruments. Gravity measurements. Gravity gradiometers. Inertial navigation systems. *Ocean instrumentation:* Gravity measurements at sea. Tide gauges. Ocean pressure measurement. Bathymetry. Positioning on deep-ocean floor. *Space instrumentation:* Radio Doppler. Satellite laser ranging, global positioning system. Drag-free satellite technology, long base-line microwave interferometry. Satellite altimetry.

29.207G Doppler Positioning **SS L2T1 C3**

Introduction to Doppler positioning using the NNSS satellite system. The use of point positioning, translocation and short arc techniques. Review of available hardware. Majority voting; general and specialised reduction techniques. Computing techniques associated with the integration of Doppler positions into terrestrial network. Introduction to the Global Positioning System (GPS).

29.314G Geodetic Astronomy **SS L3T3 C6**

Some aspects of precise determinations of latitude, longitude and azimuth. PZT and Danjon astrolabe. The Laplace equation (implications of Black and Gregerson methods). Personal error. Precise timing; radio time signals and recording. Simultaneous determinations. Equal altitude techniques.

29.516G Mathematical Model of the Imaging Process **SS L3T0 C3**

Fundamental relationships, image and object space. Co-ordinate systems, collinearity equations. Interior orientation, camera calibration methods, direct linear transformation. Deviations from collinearity, use of reseaus. Generation of fictitious photographs. Realtime equations for analytical plotters, trade-offs in formulation. Simple exterior orientation of a single image. Non-frame sensors, unconventional imagery. Co-ordinate measuring devices.

29.517G Stereophotogrammetry **SS L2T1 C3**

Fundamental projective relationships, observation procedures, stereoscopic pointing. Relative orientation: empirical and numerical solutions. Absolute orientation; instrumental, numerical and graphic solutions. Model deformations from errors of interior, relative and absolute orientation. Composite spatial errors. Special cases: partial overlaps, mountainous terrain.

29.518G Analytical Photogrammetric Orientation **SS L3T0 C3**

Prerequisite: Prior knowledge of FORTRAN computer programming is assumed.

Review of method of least squares. General orientation determination for one and two images. Direct formation of reduced normal equations. Parameter estimates as observations. Use of constraints. Exterior orientation for analytical plotters. Relative and absolute orientation as special cases. Computer programs.

29.519G Photogrammetric Instrumentation **SS L2T1 C3**

Theory of instruments: comparators, restitution instruments, approximate instruments, ancillary equipment. Testing and calibration of instruments.

29.520G Photogrammetric Production Processes **SS L1½T1½ C3**

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry. Digital terrain models.

29.521G Control Extension A **SS L3T0 C3**

Prerequisite: 29.517G or consent of the instructor.

Early methods of photogrammetric control extension: radial triangulation, stereotemplets, bridging. Strip trangulation by picture connection in space. Method of independent bases. Independent models, perspective centre calibration. Graphic and numerical strip adjustment by polynomials. Analytical strip triangulation. Adjustment of blocks by iterated strip adjustment.

29.522G Control Extension B **SS L3T0 C3**

Prerequisite: 29.518G.

Simultaneous adjustment of strips and blocks: Anblock, general independent models, bundle method. Combining model and bundle concepts. Solution of large systems of symmetric, strongly diagonal, linear equation arrays: recursive partitioning, relaxation methods. Trade-offs in processing methods for different computer configurations. Computer programs.

29.601G Remote Sensing Principles and Procedures **S1 L2T1 and S2 L1½T1½ C6**

Electromagnetic radiation. Definition and physics of basic quantitites. Photographic film, images and sensors. Electro-optical sensors. Data systems. Examples of operational systems. Positioning, preprocessing deconvolution, enhancement and classification theory and application to Landsat data. Project involving processing of Landsat data.

29.602G Mass Appraisal Methods **SS L2T1 C3**

Property and property value. Early rent theory. Location theory. The interrelationship between land use and value. Traditional methods of appraisal. Appraisal methods using multivariate analysis. Comparison of methods. Recent studies on the determinants of property value. Multiple regression analysis, general linear models, trend surface analysis, factor and discriminant theory and application. Collection and coding of property data. Examination of temporal variation and trends. Graphic output of data-isoval maps. Value as one component of an urban information system.

29.603G Statutory Controls of Land Development **SS L2T1 C3**

Detailed examination of the subdivision and development process in N.S.W., with particular emphasis on the statutory procedures and controls at the local government level. The Local Government Appeals Tribunal and its major relevant decisions. Local Government and land development law. Case studies in land development.

29.604G Land Information Systems **SS L2T1 C3**

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerisation of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters.

29.706G Survey Management **SS L2T1 C3**

Introduction to management accounting. Information systems and accounting, balance sheets, income statements, accounting reports, costing, budgets and capital investment decisions.

29.707G Quantitative Management Methods **SS L2T1 C3**

Detailed analysis of operations research methods and discounted cash flow techniques as they apply to mapping, surveying and development projects. Various case studies and their solutions will be examined.

29.909G Project **C9**

See Section on Graduate Study earlier in this book for details of research areas in the School.

29.918G Research Project **C18**

See section on Graduate Study earlier in this book for details on research areas in the School.

29.936G Research Project **C36**

See section on Graduate Study earlier in this book for details of research areas in the School.

Biomedical Engineering

Graduate Study

32.010G Biomedical Engineering Practice **S1 L2½ C2**

Introduction to clinical situations in hospitals. Presentation of guest lectures by eminent people working in this field. Lecture topics include cardiology, neurology, orthopaedics, rehabilitation, etc. Visits to various biomedical engineering units.

32.012G Biomedical Statistics **S1 L2½ T1½ C4**

Statistical assessment of normal and diseased states. Statistical relationships between multiple variables used to assess disease; analysis of variance, regression, factor analysis, discriminant analysis. Progression of diseases over time. Diagnosis and assessment of treatments. Experimental design and sampling. Computation methods.

32.018G Research Project **C18**

32.020G Radiation Physics **S2 L2T2 C4**

Sources, effects and uses of various types of radiation on human tissues. Ultrasonic, X-ray and nuclear radiations are included together with ultraviolet, infrared, laser, microwave and longer wavelength electromagnetic effects. Precautions in using these radiations are stressed.

32.030G Research Project **C30**

32.101G Mathematical Modelling for Biomedical Engineers **S1 L3T1 C4**

Model formulation and validation, solution of ordinary and partial differential equations by analytical and numerical techniques.

32.311G Mass Transfer in Medicine **S2 L2T2 C4**

Material and energy balances, modelling of intrabody mass transfer, elementary treatment of diffusion, convection, hydraulic permeability and osmosis in biological and synthetic membranes. Applications to hemodialysis, blood oxygenators and artificial livers.

32.321G Fluid Mechanics for Artificial Organs **S2 L2T2 C4**

An appreciation subject dealing with the fundamentals of fluid flow and the governing equations. Friction and viscosity, streamline and turbulent flow, flow of gases and liquids in the body and in artificial organs.

32.331G Biocompatibility **S1 L2 C2**

Interaction of biological fluids with foreign surfaces, *in vitro* tests to assess biocompatibility and thrombogenicity, hemofiltration, current status of biocompatible materials as applied to hemodialysis, membrane oxygenation and prosthetic devices.

32.500G Computing for Biomedical Engineers Using Fortran **S1 L2T2 C3**

Introduction to computing facilities, getting information in and out of the computer, program development, logic statements and loops, precision and accuracy subroutines and functions, debugging, matrices, declarations, program design and documentation, printer plotting, computer graphics, editing (XEDIT/MODIFY), KCL and procedure files. Overview of computers in biomedical engineering, including an introduction to aspects of automated patient monitoring and laboratory testing. Microprocessors and their capabilities. Data storage and information retrieval. Assessment of hospital computing requirements and evaluation of computer packages.

32.510G Introductory Biomechanics S1 L2T1 C3

Replaces 5.490G.

The principles of the mechanics of solid bodies: force systems; kinematics and kinetics of rigid bodies; stress-strain relationships; stress analysis of simple elements.

32.511G Mechanics of the Human Body S2 L2T2 C4

Prerequisite: 32.510G or equivalent.

Replaces 5.493G.

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

32.521G Biomechanics of Physical Rehabilitation S1 L2T2 C4

Prerequisite: 32.510G or equivalent.

Replaces 5.495G.

The application of biomechanics principles to the areas of: performance testing and assessment, physical therapy, design of rehabilitation equipment, design of internal and external prostheses and orthoses.

32.531G Mechanical Properties of Biomaterials S1 L2T2 C4

Prerequisite: 32.510G or equivalent.

Replaces 5.494G.

The physical properties of materials having significance to biomedical engineering: human tissues; skin; soft tissues; bone; metals; polymers and ceramics: the effects of degradation and corrosion.

32.611G Medical Instrumentation S2 L2T1 C3

A critical survey of the theory and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories.

32.621G Biological Signal Analysis S1 L3 C3

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

Town Planning

Undergraduate Study

36.411 Town Planning S1 L2T1

Introduction to the purpose, scope and application of planning.

The urban planning process. Objectives and means of planning cities. Levels of planning and types of plans. Regional, metropolitan, neighbourhood planning. Ecological land use planning. Environmental impact assessment. Planning law and administration. Future of cities.

Biotechnology

Graduate Study

42.211G Principles of Biology S1 L3 C3

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

42.212G Principles of Biochemistry S1 L3 C3

A condensed treatment of biochemistry comprising the following aspects: the elemental and molecular composition of living organisms; the chemistry and roles of the biological elements and molecules; the thermodynamics and enzymatic catalysis of metabolism; catabolic, anabolic, amphibolic and anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, β-oxidation and synthesis of fatty acids, deamination and decarboxylation of amino acids, the tricarboxylic acid cycle, electron transport and oxidative phosphorylation; metabolic regulation and integration.

Chemical Engineering and Industrial Chemistry

Undergraduate Study

48.302 Fuels and Energy **S2 L3 T1**

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

Anatomy

Undergraduate Study

70.011C Introductory Anatomy **S1 L2T4 C6**

Introduction to gross anatomy, based on a study of prosected specimens. Musculoskeletal, cardiovascular, respiratory, gastrointestinal, genito-urinary and nervous systems. General topographical and surface anatomy. Normal variations including those related to sex and age (childhood, adolescence, maturity and senescence).

70.306 Functional Anatomy I **S1 L2T4**

Prerequisites: 70.011A, 70.011C.

Introduces fundamental issues in the morphology and dynamics of human movement systems, including physical properties of bone, muscle and connective tissue; biomechanics, movement analysis and neuromuscular control. These basic principles are applied to a detailed study of musculoskeletal components of head and neck and upper limb. Emphasis on modern analytical techniques and findings. Tutorials include detailed limb and joint dissections plus intensive study of surface and radiological anatomy.

Pathology

Graduate Study

72.402G Principles of Disease Processes **S1 L3 C3**

Prerequisite: 73.111 or equivalent, 70.011C or equivalent.

For MBiomedE students only.

The reaction of cells to injury, the inflammatory reaction; necrosis-vascular changes and infarction; reparative processes; fracture healing; neoplasia; reaction to implants; specific processes requiring prosthetic assistance.

Physiology and Pharmacology

Undergraduate Study

73.111 Physiology 1A **F L2T4 C12**

Introduction to fundamental physiological principles — basic cellular function in terms of chemical and physical principles, and operation of the various specialized systems in the body; for example, the cardiovascular system, the respiratory system, the gastrointestinal system, the kidney, the endocrine system and the nervous system.

Division of Postgraduate Extension Studies

Graduate Study

97.001G Linguistics and Written and Spoken Communication **S1 L2T1 C2**

The broad purpose of the lectures on linguistics is to analyse the structure of English on the phonetic, phonemic, morphological and syntactical levels but in making this analysis, consideration is given to:

The different general approaches to linguistics: eg traditionalist, structuralist, generative and transformationalist; specific matters in theoretical dispute; eg the statistics of the phoneme; experimental and instrumental research; eg spectrographic examination of English sounds and their combination; correlations between acoustic phenomena and the perceived sounds of English; the statistics of written and spoken English. Types of communication problems; establishing identity of purpose or common ground; essential differences between written and spoken English; limitation of words; visual aids to comprehension; preparation of factual or technical reports.

97.002G Basic Information Theory **F L1T2 C6**

Nature and description of information. Measurement of information flow. Information content of printed, audio and video signals. Concept and measurement of redundancy. Capacity of a channel, bandwidth and power considerations. Signals in the presence of noise and crosstalk. Applications of feedback theory to communication. Entropy and mutual information. Coding. Neurological model theories. Feedback and information flow in the human nervous system. Information storage and retrieval.

97.003G Human Transinformation **F L1T2 C6**

Review of transfer functions, feedback and statistical tests. Measurement of information and coding, entropy, codes and relevant coding theorems. Human information source and sink characteristics, language, Markov and Zipf, transinformation models of ear and eye. The channel, Baye's theorem, entropy and equivocation in human context. Multivariate systems in the human group context, stochastic model in the time domain.

97.004G The Psychology of Communication **S1 L2T1 C3**

The basic communication process analysed in terms of Source, Medium/Message, Respondent and Effects. A social context theory of communication relating the influence of groups, roles, social class, power, status etc on communication. Attitude change through communication. Statistics and statistical analyses in the experimental study of communication.

97.005G Audio and Video Equipment — Capabilities and Applications **S2 L2T2 C4**

Aims to give an understanding of the characteristics of equipment used in sound recording and broadcasting, television and printing with some reference to mechanical detail. Topics: audio systems; testing of audio equipment; microphones and loudspeakers; amplifiers; sound transmission; level control, recording and reproduction; studio acoustics; sound mixing; editing and effects. Television scanning; television signals; camera tubes and cameras; television receivers and picture monitors; basic concepts of colour television; the PAL colour television system; switching, mixing and processing of television signals; lighting equipment; studio floor equipment, digital signal processing equipment. Printing processes; letterpress, gravure and lithography. Photography.

97.007G Audio and Video Signals in Communication **S1 L1T2 C3**

Wave-theory. Propagation through media. Studio and free space acoustics. Measurement of loudness and noise. Signal fidelity.

Light in electromagnetic spectrum. Chrominance — hue and saturation. Chromaticity diagram and colour triangle. Measurement of illumination and brightness. Basic lighting design.

97.008G The Body in Communication **S2 L1T2 C2**

Vocal organs. Phonation. Formant patterns of speech. Acoustic specifications of speech. Mechanism and characteristics of the ear. Mechanism and characteristics of the eye. Sensation. Vision defects and illusions. The brain. Neurological signal transmission characteristics. Reflexaction. Organization of motor system.

97.010G Basic Fortran **F L1 C2**

Introduction to computer programming using FORTRAN and BASIC for people with no computer experience and no mathematical training beyond High School mathematics. Practice at programming and debugging, with problems taken from both data processing and scientific applications. Input and Output FORMAT statements; Nested DO loops; Arithmetic statement functions; Matrix arrays; Implied DO loops; Function subprograms and subroutine programs; Sorting and merging techniques; Common Storage; Communicating with peripherals of microcomputer; program planning and debugging.

97.012G Project **S2 T5 C5**

97.013G Presentation of Information **S1 L1T2 C3**

Communication in education. Formal education and the mass media. Production and presentation of information by audio and video displays.

97.014G Thesis **F C18**

97.031G Linguistics and Written and Spoken Communication **C1**

As for 97.001G (lectures only).

97.032G Basic Information Theory **C1**

As for 97.002G (lectures only).

97.034G Psychology of Communication **C2**

As for 97.004G (lectures only).

97.035G Audio Video Equipment **C2**

As for 97.0075 (lectures only).

97.037G Audio Video Signals in Communication **C1**

As for 9.007G (lectures only).

97.038G The Body in Communication **C1**

As for 97.008G (lectures only).

97.043G Presentation of Information **C1**

As for 97.013G (lectures only).

97.046G Introduction to Microprocessor Systems **C2**

Review of semiconductor technologies and their development. Digital logic and integrated circuit devices. Codes. Microprocessors and their bus signals. Fundamental computer cycles and internal operations. Programmer's model of a microcomputer system. Instruction sets and simple machine language programs. Semiconductor memory devices and their interfacing. Interfacing and programming of serial and parallel input. Output devices and the connection of a variety of special purpose functions to these, such as displays, analog converters, etc. Description of software development tools including monitors, assemblers, EPROM programmers and higher level languages. An overview of magnetic tape recording, floppy disks, cathode ray tube raster scan displays and keyboards.

97.345G Active and Adaptive Circuits **C3**

Revision of discrete and distributed RC synthesis as a preliminary to the discussion of active elements embedded in RC networks. The synthesis of linear active RC systems (with controlled sources, negative immittance converters, gyrators, etc), including state-space methods. Sensitivity considerations and integrated realization. Non-linear and time-variable circuits. Adaptive filters for equalization and echo cancelling. Circuit techniques for achieving reliability in integrated circuits.

Financial Assistance to Students

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. Each faculty handbook contains in its **Financial Assistance to Student** 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 earlier in this Handbook (see **General Information: Financial Assistance to Students),** there are a number of scholarships available to students. What follows is an outline only. Full information may be obtained from the Student Records, Higher Degrees and Scholarships Section, located on the Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar by 14 January each year. Please note that not all of these awards are available every year.

Donor	Value	Year/s of Tenure	Conditions
General			
Bursary Endowment Board*	$150 pa	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding $4000

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060 immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need
Girls' Realm Guild	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need
Engineering			
Electrical Engineering			
The Tyree Electrical Company Pty Ltd	Up to $4000 over 4 years	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to the full-time degree course in Electrical Engineering
Mechanical Engineering			
The Fox Manufacturing Company	Up to $1500 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to the full-time degree course in Mechanical Engineering
James Howden & Co Australia Pty Ltd	Up to $400 pa	1 year	Permanent residence in Australia and eligibility for admission to the full-time degree course in Mechanical Engineering
Surveying			
The Institution of Surveyors, NSW Division	Up to $250 per session	In parts 4, 5, 6 and 8 of the full-time course	Permanent residence in Australia and eligibility for admission to the full-time degree course in Surveying

Graduate Scholarships

Application forms and further information are available from the Student Records, Higher Degrees and Scholarships Section, located on the Ground Floor of the Chancellery. This unit provides information on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

Where possible, the scholarships are listed in order of the schools within the faculty.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Research Awards	Living allowance of $4200 pa. Other allowances may also be paid.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates (or equivalent). Applications to Registrar by 31 October (30 November in special circumstances)
Commonwealth Postgraduate Research Awards			Applicants must be honours graduates (or equivalent) or scholars who will graduate with honours in the current academic year, and who are domiciled in Australia.
Commonwealth Postgraduate Course Awards		1-2 years; minimum duration of course	Preference is given to applicants with employment experience. Applicants must be graduates or scholars who will graduate in the current academic year, and who have not previously held a Commonwealth Postgraduate Award. Applications to Registrar by 30 September (in special circumstances applications will be accepted until 30 November).
Australian-American Educational Foundation Travel Grant*			Applicants must be graduates, senior scholars or post-doctoral Fellows. Applications close 30 September.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women.

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

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The British Council Academic Links and Interchange Scheme†	Cost of travel to UK		Applicants must be either senior or junior academic staff. Preference will be given to activities likely to lead to further collaboration through joint research, publication, and/or teaching programs. Applications may be made at any time and should be submitted to the Registrar.
The Caltex Woman Graduate of the Year	$5000 pa for further studies in USA, UK, Northern Europe or in special cases Australia. There are no special allowances for travel or accommodation for married graduates.	2 years	Applicants must be female graduates who will have completed a University degree or diploma this year and who are Australian citizens or have resided in Australia for at least seven years. Selection is based on scholastic and literary achievements, demonstrable qualities of character, and accomplishments in cultural and/or sporting/recreational activities.
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	Applicants must be graduates who are Commonwealth citizens or British Protected Persons, and who are not older than 35 years of age. Applications close with Registrar by 1 October.
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.
The English-Speaking Union (NSW Branch)	$5000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia.
Gowrie Graduate Research	Maximum $2000 pa in Australia, and $2750 if tenable overseas	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War.

†Application forms available from The British Council, PO Box 88, Edgecliff, NSW 2077.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Harkness Fellowships of the Commonwealth Fund of New York*	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	Between 12 to 21 months	Candidates must be either: **1.** Members of the Australian or a State Public Service or semi-government Authority. **2.** Staff or graduate students at an Australian university. **3.** Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 36 years of age. Applications close July.
Frank Knox Memorial Fellowships at Harvard University	Stipend of $4000 pa plus tuition fees	1, sometimes 2 years	Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian University.
Nuffield Foundation Commonwealth Travelling Fellowships†	Living and travel allowances	1 year	Australian citizens usually between 25 and 35 who are graduates preferably with higher degrees and who have at least a year's teaching or research experience at a university. Applications close by February.
The Rhodes Scholarship**	Approximately £4000 stg pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens, between the ages 19 and 25 who have been domiciled in Australia at least 5 years and have completed at least 2 years of an approved university course. Applications close in early September each year.
Rothmans Fellowships Award‡	$14000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applications close early September each year.

*Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, Box 3947, GPO, Sydney, NSW 2001. These must be submitted to the Registrar by 24 July.

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

†Applications to the Secretary, The Nuffield Foundation Australian Advisory Committee, PO Box 783, Canberra City 2601.

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

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Engineering			
Harold G. Conde Memorial Fellowship	$4700 plus allowances	1 year. Renewable up to 3 years	Applicants should be honours graduates permanently domiciled in Australia. The Fellowship is for graduate study or research in a field related to the electricity industry.
University Fellowships in Highway Engineering	$4200 pa plus allowances	Course Work: 1 year Research: 1 year, renewable	The Fellowship enables scholars to complete a Master of Engineering Science Course in Highway Engineering, or alternatively undertake research leading to a Master of Engineering or PhD degree.
Australian Institute of Nuclear Science and Engineering Studentships	Single students $4641 pa. Dependent spouse allowance $1632 pa, $390 for each dependent child, plus some University expenses	1-3 years	Applicants must be graduates in Nuclear Science or Engineering. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW.
Australian Institute of Nuclear Science and Engineering Research Fellowship†	$13000-$17000 pa plus certain travel and supporting grants	Minimum of 2 years. Maximum of 3 years	To enable graduates holding a PhD degree or similar qualification to undertake graduate work in Nuclear Science and Engineering.
The Joseph Barling Fellowship	Not less than $10000 less fees	Maximum of 3 years	Candidates should be electrical engineering graduates of the University of New South Wales (in special circumstances mechanical and industrial engineering graduates may apply). The Fellowship is for full-time study for the award of the degree of Master of Business Administration, Master of Public Administration or Doctor of Philosophy at the University. Applications close 30 November.
Shell Scholarship in Science or Engineering	Approximately £4000 stg pa plus travelling expenses	2 years, sometimes 3	Applicants must be unmarried, male, Australian citizens, under 25 years of age, with at least 5 years, domicile in Australia and who are completing the requirements for an honours degree in Science or Engineering. The successful candidate will undertake 2 years' graduate study towards the award of a higher degree at a British university.

†Applications to The Registrar, or AINSE Private Mail Bag, Sutherland 2232.

Prizes

Undergraduate University Prizes

Donor/Name of Prize	Value $	Awarded for
General		
Sydney Technical College Union Award	50.00 and medal	Leadership in the development of student affairs, and academic proficiency throughout the course.
University of New South Wales Alumni Association	Statuette	Achievement for community benefit — students in their final or graduating year.
Faculty of Engineering		
Institution of Engineers, Australia	Medal and 100.00	The most proficient final year (or last 2 years part-time) student in the Bachelor of Engineering (or Bachelor of Science (Engineering)) Degree courses offered by the following Schools: Civil Engineering Electrical Engineering Mechanical and Industrial Engineering Chemical Engineering Mining Engineering Textile Technology (Engineering option only)
The John Fraser Memorial Award	130.00	Excellence in the first year or equivalent part-time years of a bachelor's degree course offered by the Faculty of Engineering
School of Civil Engineering		
Australian Conservation Foundation	50.00	Outstanding performance in subjects which develop environmental management concepts
Australian Welding Institute	30.00	Best design using a welding process for students in Years 2, 3 or 4

Undergraduate University Prizes (continued)

School of Civil Engineering (continued)

Donor/Name of Prize	Value $	Awarded for
The Association of Consulting Structural Engineers of New South Wales	100.00	General proficiency — Structures in the Bachelor of Engineering degree course in Civil Engineering
	100.00	General proficiency — Structures in the Bachelor of Science (Engineering) degree course in Civil Engineering
BMI Ltd Systems Engineering	50.00	8.301 Systems Engineering
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Crawford Munro Memorial	150.00	Highest proficiency in 8.582 Water Resources II taken for the first time
Department of Civil Engineering Materials Staff	50.00	Best aggregate mark in the subjects 8.273 Civil Engineering Materials II and 8.274 Civil Engineering Materials III
Dillingham Australia Pty Ltd	100.00	Academic and professional excellence shown in the field of Construction Estimating
Harbin Polytechnical Alumni Association	75.00	Subject selected by Head of School
James Hardie Co Pty Ltd	100.00	Highest proficiency in 8.571 Hydraulics I taken for the first time
Hornibrook	100.00	Proficiency in Engineering Construction and Management

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering (continued)		
Rural Bank of NSW	50.00	Outstanding performance in 8.673 Planning and Management II
Water Board Gold Medal	Medal	Public Health Engineering
School of Electrical Engineering and Computer Science		
Austral Crane	37.50	Bachelor of Engineering degree course in Electrical Engineering, Year III
	37.50	Power or Control elective
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Electricity Supply Engineers Association of New South Wales	40.00	Overall performance including proficiency in Electric Power Distribution in third year full-time or equivalent part-time degree course.
J. Douglas Maclurcan	40.00 book order	Control Systems
The Wilfred Holmes Memorial Award	120.00	A student eligible to enter the final year of the degree course and who is deemed to be in necessitous circumstances
School of Mechanical and Industrial Engineering		
Atlas Copco	75.00	General proficiency in Bachelor of Engineering course in Mechanical Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Industrial Engineering (continued)		
Austral Crane	75.00	Full-time Year III Mechanical Engineering
Babcock & Wilcox Aust Ltd	30.00	Subject selected by Head of School
Chamber of Manufacturers of New South Wales	15.00	
CSR Limited	50.00	
Ford Motor Co of Aust Ltd	50.00	
David Carment Memorial	350.00 and medal	Highest proficiency in final year of Naval Architecture course
Harbin Polytechnical Alumni Association	75.00	Subject selected by Head of School
Jeremy Hirschhorn	20.00	Theory of Machines
Royal Institution of Naval Architects	40.00	Bachelor of Engineering or Bachelor of Science (Engineering) degree course in Naval Architecture, final year or stage
Staedtler (Pacific) Pty Ltd	50.00 (order)	General proficiency in Bachelor of Engineering Course in Mechanical Engineering, Year II
Department of Industrial Engineering		
Austral Crane	75.00	Bachelor of Engineering degree course in Industrial Engineering, Year III
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Industrial Engineering (continued)		
Department of Industrial Engineering (continued)		
R. E. Jefferies Memorial	100.00	Performance in final year/stage of Bachelor of Engineering degree course in Industrial Engineering
TRW Australia Ltd	20.00	Bachelor of Science (Engineering) degree course in Industrial Engineering, Stage 6
School of Surveying		
Board of Surveyors Medal	Medal	Bachelor of Surveying degree course, Final Year
R. S. Mather Memorial	75.00	Most outstanding student in Geodesy

Graduate University Prizes

School of Civil Engineering		
Institute of Advanced Motorists	20.00	Traffic Planning and Control
Wabco Aust Pty Ltd	400.00	Most distinguished graduate in the Master of Engineering Science degree course in Highway Engineering

Faculty of Engineering

Staff

Comprises Schools of Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Industrial Engineering, Nuclear Engineering, and Surveying; and Centre for Biomedical Engineering.

Dean
Professor N. L. Svensson

Chairman
Professor N. L. Svensson

School of Civil Engineering

Professor of Civil Engineering, Head of School and of Department of Engineering Construction and Management
Ronald William Woodhead, BE *Syd.*, ME *N.S.W.*, FIEAust, FAIB, MASCE, MAIC, MPMI, MACI, MIQ, MAACE

Professor of Civil Engineering and Head of Department of Civil Engineering Materials
Ian Kenneth Lee, BCE MEngSc PhD *Melb.*, FIEAust, MASCE

Professor of Civil Engineering and Head of Department of Structural Engineering
Vacant

Professor of Traffic Engineering and Head of Department of Transport Engineering
William Ross Blunden, BSc BE *Syd.*, FCIT(Lond), FITE(Wash), FIEAust, MStatSocAust

Professor of Civil Engineering
Vacant

Honorary Visiting Professor
James Macquarie Antill, BE *Syd.*, ME *N.S.W.*, FIEAust, FIArb, FIArbA, AMAusIMM

Honorary Associates
Desmond Ford Glynn, BCE *Melb.*, MIEAust, MASCE
Alexander Wargon, MSc *Harv.*, CE, FIEAust, FASCE, MNZIE

Senior 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, Metals and Welding Technology.

Associate Professors

Owen Graeme Ingles, BA MSc *Tas.*, CEng, CChem, FRIC, MIEAust, MInstF

Somasundaram Valliappan, BE *Annam.*, MS *Northeastern*, PhD *Wales*, MASCE

Geoffrey Baldwin Welch, BE *Syd.*, ME *N.S.W.*, CEng, MICE, FIEAust

Senior Lecturers

William Henry Cogill, MSc(Eng) *Cape T.*, MSc *Camb.*, PhD *N.S.W.*, FIEAust, MICE

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

Esca Morrice Kitchen, BE *Syd.*, MIEAust

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

John Maurice Wheatley, MA PhD *Camb.*, CEng, FIM, FAusWI, MWeldI (Lond)

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

Lecturers

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

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

Weeks White, BSc BE *Syd.*, MIEAust

Stephen Ross Yeomans, BSc PhD *N.S.W.*, CEng, MIM

Teaching Fellow

Angelo Cipullo, DrGeolSci *Rome*

Professional Officers

Trinh Cao, BE *Monash*

Nam Lim, BE *Hanyang*, MSc *N.S.W.*

Ghodratollah Tamaddoni, BEngAg *Tehran*, DAgSc *Gembloux*

Programmer

Damian McGuckin, BSc BE *Syd*

Department of Engineering Construction and Management

Includes Systems Engineering, Engineering Economy, Project Planning and Management.

Associate Professor

Alan Frank Stewart Nettleton, BSc BE *Syd.*, ME *N.S.W.*, DIC

Senior Lecturers

Arthur Gordon Douglas, ME *N.S.W.*, PhD *Mich. State*, MIEAust

Lawrence Vincent O'Neill, BE *Syd.*

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

Lecturers

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

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

Tutor

John Laurence Knott, BE *N.S.W.*

Professional Officers

Anatole Baidjurak, BE *N.S.W.*, GradIEAust

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

Analyst Programmer

Eleanor Ruth Langley, BA *Syd.*, MACS

Department of Structural Engineering

Includes Structural Analysis, Structural Design, Stress Analysis and Solid Mechanics.

Associate Professors

Horace Joseph Brettle, BE *Syd.*, PhD *N.S.W.*, DIC, ASTC, FIEAust

Kenneth Alan Faulkes, ME *N.S.W.*, MS *Ill.*, PhD *N.S.W.*, MIEAust

Robert Alexander Frisch-Fay, DiplEng *Bud.*, ME *N.S.W.*, MIEAust

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

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

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

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

Senior Lecturers

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

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

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

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

Lecturers

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

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

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

Professional Officer

John Wesley Carrick, BE *N.S.W.*

Department of Water Engineering

Includes Hydraulics, Hydrology, Public Health Engineering, Water Resources Engineering, and the Water Research Laboratory.

Associate Professor and Head of Department
Bernard William Gould, BE *Tas.*, ME *N.S.W.*, MIEAust

Associate Professors
Douglas Neil Foster, BE *Syd.*, MIEAust
David Trewhella Howell, BE *Syd.*, ME *N.S.W.*, MIEAust, MAIAS
David Herbert Pilgrim, BE PhD *N.S.W.*, FIEAust
Keith Kingsford Watson, BE *Syd.*, ME PhD DSc *N.S.W.*, FIEAust

Senior Lecturers
David Barnes, BSc PhD *Birm.*, MIWSE, AMICE
Peter John Bliss, BE *N.S.W.*, MSc *Lond.*, DIC, ASTC, MIEAust
Ian Cordery, ME PhD *N.S.W.*. MIEAust
Colin Raymond Dudgeon, ME *N.S.W.*, MIEAust, MASCE
Trevor Regis Fietz, ME *N.S.W.*
John Robert Learmonth, BE *Syd.*, ME *N.S.W.*
David Keith Robinson, BSc BE PhD *N.S.W.*, MIEAust, MASCE
David Lyon Wilkinson, BE *Syd.*, PhD *N.S.W.*, MIEAust

Lecturer
Brian Selby Jenkins, BE PhD *N.S.W.*, ASTC, MIEAust, LGE

Tutor
Roger Benson Tomlinson, BE *N.S.W.*, GradIEAust

Professional Officers
David George Doran, BE DipCompSc *Qld.*, MEngSc *N.S.W.*, MIEAust
Kenneth Brian Higgs, MSc *Aston*, MAIP

Department of Transport Engineering

Senior Lecturers
Alec James Fisher, BSc *Lond.*, PhD *N.S.W.*, FIESAust
Robert Alexander Jones, BE *W.Aust.*, ME *Auck.*, MSc *Lond.*, DIC, MIEAust, LS(NZ)
Ross Donald Munro, BSc *W.Aust.*, BA *Melb.*, FSS
Brian Shackel, BE *Sheff.*, MEngSc PhD *N.S.W.*, MIEAust, MASCE
Theo ten Brummelaar, BE MEngSc *N.S.W.*, MIEAust
John Irwin Tindall, BE *Qld.*, BCom ME *N.S.W.*, MIEAust

Lecturers
John Andrew Black, BA *Manc.*, PhD *Brad.*, MTCP *Syd.*, AMIT
Michael Clarence Dunne, BSc PhD *Adel.*

Professional Officers
Roger Roy Hall, BSc *A.N.U.*, MSc *N.S.W.*, FESANZ, MIESAust
Clement Edward Quinlan, GradDip *N.S.W.*, ASTC, MIEAust
Andrzej Waldemar Raczkowski, Mgrinz *T.U. Warsaw*, MIEAust
Colin John Wingrove, BSc MEngSc *N.S.W.*

School of Electrical Engineering and Computer Science

Professor of Electrical Engineering – Systems and Control and Head of School
Neville Waller Rees, BSc PhD *Wales*, FIEAust

Professor of Electrical Engineering – Communications
Antoni Emil Karbowiak, DSc(Eng) *Lond.*, CEng, FIEAust, FTS, FIREE, SMIEE

Professor of Computer Science
Murray William Allen, BE *Adel.*, PhD *Syd.*, CEng, FIREE, MIEE, MIEEE

Tyree Professor of Electrical Engineering – Electric Power Engineering
Frederic John Evans, BSc BE *Syd.*, Hon. DSc *Liège*, CEng, SMIEEE, FIEE, FIEAust

Visiting Professor – Solid State Electronics
Louis Walter Davies, AO, BSc *Syd.*, DPhil *Oxf.*, FTS, SMIEEE, FInstP, FAIP, FIREE, FAA

Professor of Electrical Engineering – Electronics
Vacant

Professor of Electrical Engineering
Rex Eugene Vowels, AO, ME *Adel.*, SMIEEE, CEng, FIEAust, MIEE

Executive Assistant to Head of School
Colin Arthur Stapleton, BSc BE *Syd.*, CEng, MIEAust, MIEE, MIEEE

Senior Administrative Officer
Halsey George Phillips

Administrative Assistant
Robyn Christine Horwood, BA DipEd *N.S.W.*

Tutors
Bruce Richard Clarke, BE *N.S.W.*
Kim Huong Dinh, BE *Auck.*
Gregory Charles Hurst, BSc BE *N.S.W.*
Fuad Assia Jilwan, BE *N.S.W.*
Peter Joseph Mason, BSc BE *N.S.W.*
David Russell Milway, BSc BE *N.S.W.*
Rodney John Savage, BE *Darling Downs I.A.E.*, DipEd *Kuring-gai C.A.E.*, MIEEE
Geoffrey Robert Whale, BE *N.S.W.*
David Russell Wilkins, BE *N.S.W.*

Professional Officers
Peter Ivanov, BSc MEngSc *N.S.W.*
Jeffrey Stanley Skebe, BS *Case W.R.*, MEngSc *N.S.W.*

Analyst Programmer
Kevin Frank Hill, BE *N.S.W.*

Department of Communications

Associate Professors
Warwick Harvey Holmes, BSc BE MEngSc *Syd.*, PhD *Camb.*, SMIEEE, MIREE, MAES
The Bao Vu, BE PhD *Adel.*, SMIEEE

Senior Lecturers
Pak Lim Chu, ME PhD *N.S.W.*, MIREE
Edward Henry Fooks, BSc PhD *Lond.*, CEng, MIEE, MIEEE
Thomas Leslie Hooper, BSc *Syd.*, MSc *N.S.W.*, CEng, MIEE, MIEEE, MIREE
Israel Korn, MSc DSc *Technion, Haifa*, SMIEEE
Christopher John Elliott Phillips, BSc BE PhD *Syd.*, CEng, MIEE, MIEEE, MIREE
Robert Radzyner, BE *Melb.*, MEngSc PhD *N.S.W.*, SMIEEE, MIREE
Ramutis Anthony Zakarevicius, BSc BE MEngSc PhD *Syd.*, MIEAust, MIEEE, MIREE

Lecturers
Po Sheun Chung, MS *Ill.*, PhD *Camb.*, CEng, MIEE, MIEEE
William John Dewar, MSc(Eng) *Qu.*, PhD *N.S.W.*
Harold Leslie Humphries, BSc BE BEc *Syd.*, MIEAust, MIREE

Professional Officers
Douglas Hamilton Irving, BE *N.S.W.*
Kirill Poronnik, BE *N.S.W.*, ASTC, MIREE
Trevor Wayne Whitbread, BE *N.S.W.*

Department of Computer Science

Associate Professors
Alan Dunworth, BSc PhD *Manc.*, SMIEEE, FIREE .
John Lions, BSc *Syd.*, PhD *Camb.*, MACS

Senior Lecturers
Graham Barry McMahon, BSc *Syd.*, PhD *N.S.W.*, MACS, MACM, MASOR
Peter Clive Maxwell, MSc *Auck.*, PhD *A.N.U.*, MIEEE

Lecturers
Paul William Baker, BE PhD *N.S.W.*
David Athol Carrington, BSc *N.S.W.*
Ian James Hayes, BSc *N.S.W.*
Graham Reginald Hellestrand, BSc *N.S.W.*
Leslie Charles Hill, BE *N.S.W.*, MIEAust
Kenneth Arthur Robinson, BSc BE *Syd.*

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Keith William Titmuss, BSc(Tech) MEngSc *N.S.W.*

Department of Electric Power Engineering

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

Senior Lecturers
Trevor Robert Blackburn, BSc *Adel.*, PhD *Flin.*, GAIP
Harry Harrison, BSc BE *Syd.*, ME *N.S.W.*, MIEAust
Ronald Edward James, BSc(Eng) PhD *Lond.*, CEng., MIEE, MIMechE, AESEA
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, SMIEEE, FIREE, SMIES, MIQA

Martin Andrew Green, BE MEngSc *Qld.*, PhD *McM.*

Peter Howard Ladbrooke, BTech *Lough.*, PhD *Camb.*

John Alan Richards, BE PhD *N.S.W.*, MIREE, MIEEE

Richard Vaughan, BSc BE PhD *Syd.*

Project Scientist

Chee Yee Kwok, BSc BE 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 BSc *N.Z.*, PhD *N.S.W.*, MIEAust

Senior Lecturers

Peter Thomas Bason, ME PhD *N.S.W.*, MIEEE, MIREE

Reginald Frederick Brown, BEng *Liv.*, PhD *N.S.W.*, CEng, MIEE

Felix Lewin, BSc BE *Syd.*

David Harold Mee, BSc BE *Syd.*, PhD *Lond.*, DIC, MIREE

Darrell Williamson, BSc ME *N'cle.(N.S.W.)*, PhD *Harv.*, MIEEE

Lecturers

David James Clements, BSc *Qld.*, ME PhD *N'cle.(N.S.W.)*, MIEE, MSIAM

Kevan Charles Daly, BSc BE PhD *N.S.W.*

Professional Officers

Kevin John Flynn, BE MEngSc *N.S.W.*, ASTC

Kong Been Lee, BE MEngSc *N.S.W.*, MIEEE, AMIEE

Johan Herman Sieuwerts, BE *N.S.W.*, ASTC

School of Mechanical and Industrial Engineering

Professor of Mechanical Engineering, Head of School and of Departments of Applied Mechanics and Agricultural Engineering

Noel Levin Svensson, MMechE PhD *Melb.*, CEng, FIEAust, MIMechE, MACPSM, MIBME

Nuffield Professor of Mechanical Engineering and Head of Department of Fluid Mechanics/Thermodynamics

Raymond Alfred Arthur Bryant, ME *N.S.W.*, ASTC, CEng, FIMechE, FIEAust, MRAeS

Professor of Mechanical Engineering (on leave)

Peter Thomas Fink, CBE, BE *Syd.*, CEng, FTS, FIEAust, FIMechE, FRAeS, FRINA, MAIAA

Sir James Kirby Professor of Production Engineering

Peter Louis Brennan Oxley, BSc PhD *Leeds*, CEng, FIProdE, FIEAust, MIMechE

Professor of Operations Research and Head of Department of Industrial Engineering

George Bennett, BA *Syd.*, PhD *N.S.W.*, ASTC, CEng, FIProdE

Executive Assistant to Head of School

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

Senior Administrative Officer

George Dusan, BEc *Syd.*

Teaching Fellows

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

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

Professional Officers

Vaclav Becvar, ME *Prague*

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Walter Dollar, ASTC

Thomas Done, BA *Macq.*

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

Anthony Gordon Harris, BSc *Exe.*

Khoi Hoang, BE *Saigon*, PhD *N.S.W.*

Alexander Litvak, Dipling *Odessa*, MIEAust

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

Colin Barrington Smith, BE MEngSc *N.S.W.*, ASTC, MAIRAH, GradIEAust

Honorary Associate

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

Department of Agricultural Engineering

Senior Lecturer

Harold Glenn Bowditch, ME *N.S.W.*, ASTC, MIEAust

Lecturer

Ronald Arthur Dennis, MSc *Nott.*, CEng, MIMechE

Department of Applied Mechanics

Associate Professor

John Young Harrison, BE *Syd.*, PhD *N.S.W.*, MIEAust

Senior Lecturers

John Edward Baker, MSc *Syd.*, BE MEngSc PhD *N.S.W.*

Kerry Patrick Byrne, BE MEngSc *Qld.*, BSc *Melb.*, PhD *S'ton.*

Jacob Alexander Bruce Cartmel, MSc *Cran.I.T.*, PhD DipEd *N.S.W.*, CEng, FIMechE, FIEAust, MASME

Donald Jabez Stephen Mudge, BSc *Lond.*, DipEd *N.S.W.*, CEng, MIMechE, MIEAust, WhSc

Alexander Eric Churches, BE PhD *N.S.W.*, ASTC

Eric Joseph Hahn, BE BSc PhD *N.S.W.*, MASME

Edward Colvyn Hind, ME *N.S.W.*, ASTC, MIEAust, MInstMC

Hugh Lithgow Stark, BSc PhD *Strath.*, CEng, MIMechE, MIEAust

Lecturers

Raymond Albert Vincent Byron, BE *Syd.*, CEng, MRAeS, MAIAA

George Crawford, BE BSc *N.S.W.*, ASTC, CEng, FIEAust, MAIE, ARACI

Robin Arthur Julian Ford, BSc(Eng) PhD *Lond.*, ACGI

Richard Butler Frost, BE *N.S.W.*, MIEAust

Knut Kjorrefjord, BSc *Durh.*, CEng

Jae Lin Woo, BSc *Seoul*, SM *M.I.T.*, PhD *N.S.W.*

John Arthur Reizes, ME PhD *N.S.W.*, MIEAust

Charles Matthew Sapsford, BSc(Eng) *Lond.*, ME *N.S.W.*, CEng, MIMechE

Department of Industrial Engineering

Includes Operations Research and Production Engineering.

Associate Professor

Michael Geoffrey Stevenson, BSc(Tech) PhD *N.S.W.*, ASTC, CEng, FIEAust, MIProdE

Senior Lecturers

Leonard Edward Farmer, BE MEngSc PhD *N.S.W.*, MIEAust

Thomas Richard Jefferson, MSc *Tor.*, PhD *Northwestern*

Grier Cheng Lin, DipMechEng *P.T.I.T.*, *Taiwan*, PhD *N.S.W.*, MIEAust

Bruce Albert Murtagh, ME *Cant.*, PhD *Lond.*, DIC, CEng, MIChemE

Raymond Norman Roth, BE PhD *N.S.W.*, CEng, MIEAust

Carlton Henry Scott, BSc *Qld.*, PhD *N.S.W.*

Graham Smith, BE MEngSc PhD *N.S.W.*, ASTC, MIEAust

Lecturer

Daniel Goodridge, DiplIngChim *L'Aurore*, *Shanghai*, DiplndEng *N.S.W.*

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

Owen Francis Hughes, SB SM(NavArch) *M.I.T.*, PhD *N.S.W.*, MIEAust, MRINA, MSNAME

Senior Lecturers

Michael Richard Davis, BSc(Eng) PhD *S'ton.*, CEng, MRAeS

Lawrence Julian Doctors, BE MEngSc *Syd.*, PhD *Mich.*, AMSNAME

John Newton Hool, BE *Syd.*, DPhil *Oxf.*, ASTC, CEng, FIMechE, MIEAust

Robert Taggart Black McKenzie, MS ME *Purdue*, CEng, ARCST(Glas), FIMechE

Brian Edward Milton, BE PhD *N.S.W.*, MSc *Birm.*, CEng, MIEAust, MRAeS

Graham Lindsay Morrison, BE PhD *Melb.*

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

Olof Oscar Bils, DiplIng *Berl.*, PhD *N.S.W.*

Professional Officer

Peter Yo Pin Chen, BSc MEngSc ME PhD *N.S.W.*, ASTC

School of Surveying

Professor of Surveying, Head of School and of Department of Geodesy

Peter Vincent Angus-Leppan, BSc(Eng) *Rand.*, PhD DipTP *Natal*, FISAust, MILS(Natal), MAIC

Professor of Surveying and Head of Department of Photogrammetry

Robert Brewster Forrest, BA *Minn.*, DGeodSci *Ohio State*

Associate Professor of Surveying and Head of Department of Surveying

George Gordon Bennett, MSurv *Melb.*, PhD *N.S.W.*, RegSurv(NSW), FISAust, MIN

Administrative Officer

Joseph Valentine Fonseka, BA *Lond.*

Professional Officers

Norman John Brinsden, BE *N.S.W.*

Colin Edward Wardrop, BSc *N.S.W.*

Department of Geodesy

Senior Lecturers

Friedrich Karl Brunner, Dipling Dr techn *T.U. Vienna*

Arthur Harry William Kearsley, BSurv MSurvSc PhD *N.S.W.*, MAIC, MISAust

Artur Stolz, BSurv PhD *N.S.W.*, RegSurv(NSW)

Department of Photogrammetry

Includes Land Studies and Cartography.

Associate Professors

George James Forster Holden, DipPhoto *Lond.*, PhD *N.S.W.*, FRGS, FRICS, MISAust, MAIC

John Charles Trinder, BSurv PhD *N.S.W.*, MSc *I.T.C. Delft*, RegSurv(NSW), MISAust

Senior Lecturer

Bruce Crosby Forster, MSurv *Melb.*, MSc *R'dg.*, MISAust, LS(Vic)

Lecturers

Pratap Shivabhai Amin, BSc *T.H. Delft*, MSc *Lond.*, MISAust, MISK, CLSEA, ARICS

Leonard Berlin, BSc(LS) *Cape T.*, BSc *T.H. Delft*

Lynn Charles Holstein, MIS *N.Z.*, DipPhotogram *U.C.L.*, RegSurv(NSW), ARICS

Ian Philip Williamson, BSurv MSurvSc *N.S.W.*, RegSurv(NSW), MISAust

Department of Surveying

Associate Professor

John Stuart Allman, BSurv PhD *N.S.W.*, MISAust, MAIC

Senior Lecturers

Anthony John Robinson, BSurv MBA PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC

Jean Marc Rueger, Dipling *E.T.H. Zurich*, SIA, LS(Switz), MISAust

Lecturers

Sabapathy Ganeshan, BSc *Ceyl.*, MISAust

Klaas Ids Groenhout, BSurv MSurvSc *N.S.W.*, RegSurv(NSW), MISAust, AMAIC

Gregory Justin Hoar, BSurv PhD *N.S.W.*, RegSurv(NSW), MISAust, MAIC

John Richard Pollard, BSc *Qld.*, BTech *S.A.I.T.*

Tutors

Paul Charles Covell, BSurv *N.S.W.*

Thomas Sinclair Morrison, BSurv *N.S.W.*, RegSurv(NSW)

Centre for Biomedical Engineering

Director

Associate Professor Peter Craig Farrell, BE *Syd.*, SM *M.I.T.*, PhD *Wash.*, MASAIO, MISAO

Lecturers

Christopher David Bertram, MA DPhil *Oxf.*

Klaus Schindhelm, BE PhD *N.S.W.*

Administrative Assistant

Margaret Anne Cook, BA *N.S.W.*

Professional Officer

Walter Flicker, BE *N.S.W.*

Honorary Visiting Fellow

Tibor Timothy Vajda, DDS *Bud.*, FRSM, FACBS

Honorary Associate

Bernard Bloch, MB CRB *Witw.*, FRCS

Broken Hill Division

Staff

Director
Professor J. E. Andersen

Librarian
Peter Geoffrey Longrigg, BA *P.N.G.*, DipLib *Canberra C.A.E.*, ALAA

W.S. and L.B. Robinson University College

Head of Department of Science
Professor John Everard Andersen, BE *Melb.*, PhD *N.S.W.*, FIEAust, MAusIMM, ARACI

Head of Department of Mining and Mineral Sciences
Professor Leon John Thomas, BSc PhD *Birm.*, CEng, FIEAust, MAusIMM, MIMinE

Department of Mining and Mineral Sciences

Professional Officer
Kenneth James Murray, BSc *Syd.*, MSc *N.S.W.*, AMAusIMM

Mechanical Engineering

Lecturers
Llewellyn Ramsay Jones, BSc *N.Z.*, DipAm MEng *Sheff.*, PhD *Wales*, MIEAust, MIMechE
Ian Lachlan Maclaine-cross, BE *Melb.*, PhD *Monash*, MIEAust, MAIRAH, MSES
Chakravarti Varadachar Madhusudana, BE *Mys.*, ME *I.I.Sc.*, PhD *Monash*, MIEAust

Mining Engineering

Senior Lecturer
Venkata Satyanarayana Vutukuri, BSc(Eng) *Ban.*, MS *Wis.*, MMGI, AIME, AMAusIMM

Mineral Science

Senior Lecturer
Barenya Kumar Banerji, MSc *Patna*, PhD *Leeds*, MAusIMM

Geology

Senior Lecturer
Gerrit Neef, BSc *Lond.*, PhD *Well.*, FGS

Department of Science

Chemistry

Lecturer
Derek Richard Smith, BSc PhD *Wales*

Senior Tutor
Robert Edward Byrne, MSc *N.S.W.*, ARACI, AMAusIMM

Mathematics

Senior Lecturer
Zdenek Kviz, DipPhys *Brno*, CSc RerNatDr *Charles*, PhD *Prague*

Lecturers
David Charles Guiney, BSc PhD *Adel.*
Dennis William Trenerry, BSc PhD *Adel.*

Physics

Senior Lecturer
Robert John Stening, MSc *Syd.*, PhD *Qld.*, DipTertEd *N.E.* FRMetS, MAIP

Lecturer
Kenneth Reid Vost, BSc *Glas.*, MSc *N.S.W.*, AMAusIMM

Fowlers Gap Research Station

Officer-in-charge
Charles Richard Carter, BSc PhD *Syd.*

The University of New South Wales Kensington Campus 1981

Theatres

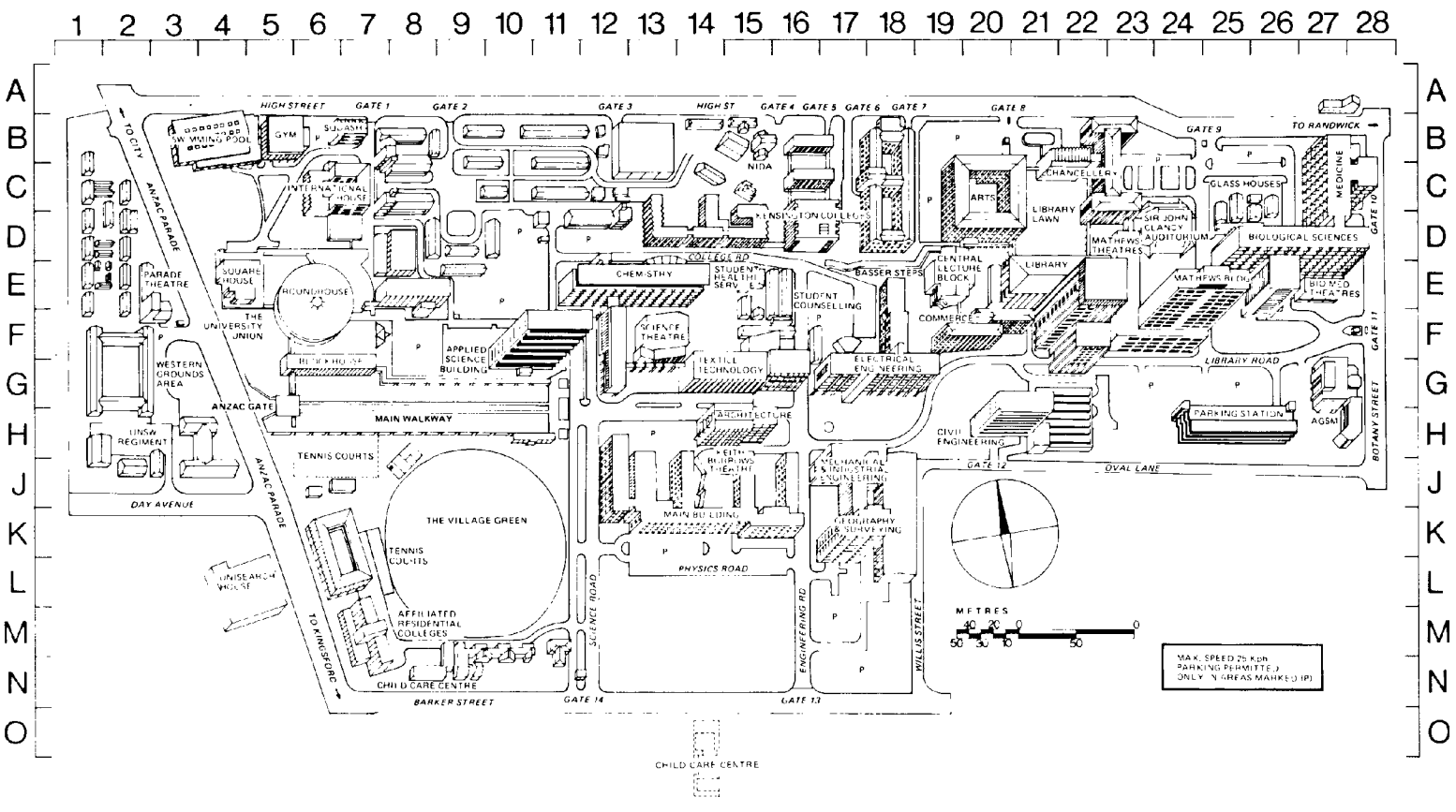
Biomedical Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Electrical Engineering Theatre F17
Keith Burrows Theatre J14
Main Building Theatrette K14
Mathews Theatres D23
Parade Theatre E3
Science Theatre F13
Sir John Clancy Auditorium C24

Buildings

Affiliated Residential Colleges
New (Anglican) L6
Shalom (Jewish) N9
Warrane (Roman Catholic) M7
Applied Science F10
Architecture H14
Arts (Morven Brown) C20
Banks F22
Barker Street Gatehouse N11
Basser College C18
Biological Sciences D26
Central Store B13
Chancellery C22
Chemistry
Dalton F12
Robert Heffron E12
Child Care Centre (Off-campus) O14
Civil Engineering H20
Commerce (John Goodsell) F20
Dalton (Chemistry) F12
Electrical Engineering G17
Geography and Surveying K17
Goldstein College D16
Golf House A27
Gymnasium B5
House at Pooh Corner N8
International House C6
John Goodsell (Commerce) F20
Kensington Colleges C17
Basser C18
Goldstein D16
Philip Baxter D14
Main Building K15
Maintenance Workshop B13
Mathews F23
Mechanical and
Industrial Engineering J17
Medicine (Administration) B27
Menzies Library E21
Metallurgy E8
Morven Brown (Arts) C20
New College (Anglican) L6
Newton J12
Parking Station H25
Philip Baxter College D14
Robert Heffron (Chemistry) E12
Sam Cracknell Pavilion H8
Shalom College (Jewish) N9
Sir Robert Webster
(Textile Technology) G14
Squash Courts B7
Swimming Pool B4
Unisearch House L5
University Regiment J2
University Union
(Roundhouse) — Stage I E8
University Union
(Blockhouse) — Stage II G6
University Union
(Squarehouse) — Stage III E4
Wallace Wurth School of Medicine C27
Warrane College (Roman Catholic) M7
Wool and Pastoral Sciences B8

General

Accountancy F20
Admissions Office C22
Anatomy C27
Applied Geology F10
Applied Science (Faculty Office) F10
Appointments Office C22
Architecture
(including Faculty Office) H14
Arts (Faculty Office) C20
Australian Graduate
School of Management G27
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biomedical Library F23
Biotechnology D26
Bookshop G17
Botany D26
Building H14
Cashier's Office C22
Centre for Medical Education
Research and Development C27
Chaplains E15a
Chemical Engineering and
Industrial Chemistry F10
Chemistry E12
Child Care Centre N8
Civil Engineering H20
Closed Circuit Television Centre F20
Commerce (Faculty Office) F20
Committee in Postgraduate Medical
Education B27
Community Medicine D26
Computing Services Unit E21
Drama D9
Economics F20
Education G2
Electrical Engineering and
Computer Science G17
Engineering (Faculty Office) K17
English C20
Examinations and Student Records C22
Fees Office C22
Food Technology F10
French C20
General Studies C20
Geography K17
German Studies C20
Graduate School of the Built
Environment H14
Health Administration C22
History C20
History and Philosophy of Science C20
Industrial Arts C1
Industrial Engineering J17
Institute of Languages G14
Institute of Rural Technology B8b
Kindergarten (House at Pooh Corner/
Child Care Centre) N8
Landscape Architecture H14
Law (Faculty Office) E21
Law Library E21
Librarianship F23
Library E21
Lost Property F20
Marketing F20
Mathematics F23
Mechanical Engineering J17
Medicine (Faculty Office) B27
Metallurgy E8
Microbiology D26
Mining Engineering K15
Music B11b
National Institute of Dramatic Art C15
Nuclear Engineering G17
Optometry J12
Organizational Behaviour F20
Pathology C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K15
Physical Education and
Recreation Centre (PERC) B5
Physiology and Pharmacology C27
Political Science C20
Postgraduate Extension Studies (Closed
Circuit Television) F20
Postgraduate Extension Studies (Radio
Station and Administration) F23
Psychology F23
Public Affairs Unit C22
Regional Teacher Training Centre C27
Russian C20
Science and Mathematics Course
Office F23
Social Work G2
Sociology C20
Spanish and Latin American Studies C20
Student Amenities and Recreation E15c
Student Counselling and Research E15c
Student Employment C22
Student Health E15b
Students' Union E4
Surveying K17
Teachers' College Liaison Office F15b
Tertiary Education Research Centre E15c
Textile Technology G14
Town Planning K15
University Union (Blockhouse) G6
Wool and Pastoral Sciences B8a
Zoology D26


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
A B C D E F G H J K L M N O
HIGH STREET
GATE 1
GATE 2
GATE 3
HIGH ST
GATE 4
GATE 5
GATE 6
GATE 7
GATE 8
GATE 9
TO RANDWICK
TO CITY
ANZAC PARADE
SWIMMING POOL
GYM
SQUASH
INTERNATIONAL HOUSE
NIDA
KENSINGTON COLLEGES
CHANCELLERY
ARTS
LIBRARY LAWN
GLASS HOUSES
MEDICINE
GATE 10
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
COLLEGE RD
CHEMISTRY
STUDENT HEALTH SERV.
BASSER STEPS
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO MED THEATRES
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNION
BEE HOUSE
APPLIED SCIENCE BUILDING
SCIENCE THEATRE
TEXTILE TECHNOLOGY
STUDENT COUNSELLING
ELECTRICAL ENGINEERING
COMMERCE
GATE 11
LIBRARY ROAD
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
AGSM
BOTANY STREET
LINNEAN REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
CIVIL ENGINEERING
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
GEOGRAPHY & SURVEYING
UNISEARCH HOUSE
TENNIS COURTS
PHYSICS ROAD
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
AFFILIATED RESIDENTIAL COLLEGES
TO KINGSFORD
CHILD CARE CENTRE
BARKER STREET
GATE 14
GATE 13
METRES
40 20 0 0
50 30 10 50
MAX. SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)
CHILD CARE CENTRE

This Handbook has been specially designed as a source of reference for you and will prove useful for consultation throughout the year.

For fuller details about the University – its organization, staff membership, description of disciplines, scholarships, prizes, and so on, you should consult the Calendar.

The Calendar and Handbooks also contain a summary list of higher degrees as well as the conditions for their award applicable to each volume.

For detailed information about courses, subjects and requirements of a particular faculty you should consult the relevant Faculty Handbook.

Separate Handbooks are published for the Faculties of Applied Science, Architecture, Arts, Commerce, Engineering, Law, Medicine, Professional Studies, Science (including Biological Sciences and the Board of Studies in Science and Mathematics), the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education.

The Calendar and Handbooks are available from the Cashier's Office. The Calendar costs $3.50 (plus postage and packing, 90 cents). The Handbooks vary in cost. Applied Science, Arts, Commerce, Engineering and Sciences are $2.50. Architecture, Law, Medicine, Professional Studies and AGSM are $1.50. Postage is 80c in each case, or $1.20 ($3.00 interstate) for a complete set of books. The exception is General Studies, which is free (80 cents postage).