The University of New South Wales

Engineering

1976 Faculty Handbook

The University of New South Wales
PO Box 1 Kensington NSW Australia 2033 Phone 6630351

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Contents

General Information

In order to minimize the time and effort that you will put into your study you should make an effort to learn what facilities the University offers, to investigate the best methods of study and to discover as much as possible about the course for which you are enrolled.

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

For fuller details about the University and its activities you should consult the University Calendar.

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

Some people who can help you

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 663 0351 and ask for the extension or dial 662—and then the extension number.

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 P. O'Brien, and his Administrative Assistant, Mr S. Briand, are located on the first floor of the Chancellery. They will see students who need advice and who have problems and are not sure whom they should see about them. Mr Briand looks after financial assistance matters. Enquire at room 148A, phone 2482 or 3164.

The Assistant Registrar (Examinations and Student Records), Mr J. Warr, is located on the ground floor of the Chancellery. For particular enquiries regarding *Student Records* (including matters related to *illness affecting study)* contact Mr. B. Newell (phone 2141), and regarding *Examinations,* Mr J. Grigg (phone 2143). This section can also advise on matters relating to *discontinuation of subjects* and *termination of courses.* General enquiries should be directed to 3711.

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

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

The Housing Officer, Mrs J. Hay, is located in the Student Amenities and Recreation Unit in Hut B at the foot of Basser Steps. For assistance in obtaining *suitable lodgings* phone 3803.

The Student Health Unit is located in Hut E on College Road. The Director is Dr M. A. Napthali. For *medical aid* phone 2679.

The Student Counselling and Research Unit is located at the foot of Basser Steps. The Head is Mr G. Gray. For assistance with educational or vocational problems ring 2600-2605 for an appointment.

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

The Chaplaincy Centre is located in Hut F at the foot of Basser Steps. For spiritual aid consult Rev B. W. Wilson (Anglican)—2684; Rev Father J. King or Rev Father M. Fallon (Catholic)—2379; Pastor H. Davis (Church of Christ)—2683; Rev P. Holden (Methodist)—2683; Pastor G. Rollo (Seventh Day Adventist)—2683; Rabbi M. Kantor (Jewish)—3273.

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

Calendar of Dates

1976

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

January

Thursday 1	New Year's Day—Public Holiday
Friday 9	Last day for application for review of results of *annual* examinations Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *annual* examinations
Monday 12	Timetables for *deferred* examinations available
Friday 16	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 26	Australia Day—Public Holiday
Tuesday 27	*Deferred* examinations begin

February

Saturday 7	*Deferred* examinations end
Monday 16	Enrolment period begins for new students and students repeating first year
Tuesday 17	Last day for appeal against exclusion by students who infringed re-enrolment rules at *annual* examinations
Friday 20	*Deferred* examination results available
Monday 23	Enrolment period begins for second and later year students
Tuesday 24	Last day for application for review of *deferred* examination results
Friday 27	Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *deferred* examinations

March

Monday 1	**Session 1 commences**
Friday 12	Last day for acceptance of enrolments by new students (late fee payable)
Thursday 18	Last day for appeal against exclusion by students who infringed re-enrolment rules at *deferred* examinations
Thursday 25	Last day for acceptance of enrolments by students re-enrolling in second and later years (late fee payable)
Friday 26	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over Session 1 only
Monday 29	Last day to enrol in additional subjects

April

Friday 16 to Monday 19	Easter
Friday 23	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 1 only
Sunday 25	Anzac Day
Monday 26	Public Holiday

May

Tuesday 4	Publication of provisional timetable for June/July examinations
Monday 10	**May Recess begins**
Wednesday 12	Last day for acceptance of corrected enrolment details forms
Friday 14	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over the whole academic year
Sunday 16	**May Recess ends**

Monday 17	Last day for students to advise of examination timetable clashes
June	
Tuesday 1	Publication of timetable for June/July examinations
Sunday 13	**Session 1 ends**
Monday 14	Queen's Birthday—Public Holiday **Midyear Recess begins**
Tuesday 15	Midyear examinations begin
Tuesday 29	Midyear examinations end
July	
Sunday 18	**Midyear Recess ends**
Monday 19	**Session 2 begins**
Friday 30	Foundation Day Last day for students attending the University for the first time to discontinue without failure subjects which extend over the whole academic year
August	
Friday 13	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 23	**August Recess begins** Holiday for non-academic staff
Sunday 29	**August Recess ends**
Tuesday 31	Last day for acceptance of applications for re-admission in 1977 after exclusion under the re-enrolment rules
September	
Friday 10	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 2 only
Sunday 12	Last day for applications from students graduating in 1977 for admission to University degrees and diplomas
Tuesday 14	Last day for return of corrected enrolment details forms
Tuesday 21	Publication of provisional timetable for annual examinations
October	
Friday 1	Last day to apply to MUAC for transfer to another university in Sydney metropolitan area and Wollongong Last day for students to advise of examination timetable clashes
Monday 4	Eight Hour Day—Public Holiday
Tuesday 19	Publication of timetable for annual examinations
November	
Monday 1	**Study Recess begins**
Sunday 7	**Session 2 ends**
Monday 8	Annual examinations begin
Tuesday 30	Annual examinations end
December	
Saturday 25	Christmas Day—Public Holiday
Monday 27	Boxing Day—Public Holiday

1977

Session 1	March 7 to May 14 *May Recess:* May 16 to May 21 May 23 to June 18 *Midyear Recess:* June 20 to July 23
Session 2	July 25 to August 27 *August Recess:* August 29 to September 3 September 5 to November 5 *Study Recess:* November 7 to November 12
January	
Monday 3	Public Holiday
Friday 7	Last date for application for review of results of *annual* examinations
Monday 10	Publication of timetable for *deferred* examinations
Friday 14	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Tuesday 25	*Deferred* examinations begin
Monday 31	Australia Day—Public Holiday
February	
Saturday 5	*Deferred* examinations end
Monday 14	Enrolment period begins for new students and students repeating first year
Friday 18	Results of *deferred* examinations available
Monday 21	Enrolment period begins for second and later year students
Tuesday 22	Last day for applications for review of *deferred* examination results

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 as well as short recesses of one week within each of the sessions.

Session 1 commences on the first Monday of March.

Organization of the University

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

In 1975 the University had 18,128 students and 3,984 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W. S. and L. B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

The Council

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

The Council consists of 42 members representative of the professions, commerce and industry, the legislature, employee organizations, rural, pastoral and agricultural interests, and the academic staff of the University, its graduates and students.

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

The Chairman of the Council is the Chancellor, Sir Robert Webster, and the Deputy Chancellor is the Hon. Sir Kevin Ellis.

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

The Dean, who is also a professor, is the executive head of the Faculty. Members of each Faculty 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. In addition, the Board of Studies in General Education fulfils a function similar to that of the faculties. The Board of Studies in Science is responsible for the academic administration of the Science course.

The Schools

Once courses of study have been approved they come under the control of the individual Schools (eg the School of Chemistry, the School of Mathematics). The professorial Head of the School in which you will be studying will be 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, 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 J. B. Thornton, Professor R. E. Vowels and Professor A. H. Willis; the Deans and the three heads of the administrative divisions.

General Administration

The administration of general matters within the University comes mainly within the province of the Registrar, Mr C. G. Plowman, the Bursar, Mr T. J. Daly, and the Business Manager (Property), Mr R. K. Fletcher.

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

The Bursar's Division is concerned with the financial details of the day-to-day administration and matters to do with staff appointments, promotions, etc. The Property Division is concerned with the maintenance of buildings and grounds and equipment, and includes the University Architect's office.

Student Representation on Council and Faculties

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 one of their number to a Faculty for each 500 registered students, with a minimum of three students per Faculty. Elections take place towards the end of the academic year for a one-year term of office.

Open Faculty Meetings

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

Identification of Subjects by Numbers

For information concerning the identifying number of each subject taught in this faculty, turn to the first page of the main section below entitled Subject Descriptions and Textbooks.

See the Calendar for the full list of identifying numbers and subjects taught in the University.

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 publishes its own Handbook which is available free of charge. All enquiries about General Studies should be made to the General Studies Office, Room G54, Morven Brown Building (663 0351 Extn. 3478).

Student Services and Activities

The University Library

The University Library is on the upper campus adjacent to the Chancellery, the Sciences Building, the Goodsell and the Morven Brown Buildings. The Biomedical Library is in the western end of the Sciences Building with a branch at Prince Henry Hospital, telephone 661 0111. The University Library buildings house the Law Library, the Physical Sciences Library, the Social Sciences and Humanities Library and the Undergraduate Library.

There are services at other centres:

Broken Hill Division: W. S. and L. B. Robinson University College Buildings, Broken Hill. Phone: 6022/3/4.

Water Reference Library: Manly Vale. Phone: 948 0261.

Each library provides a reference and lending service for staff and students, and is open in both Sessions 1 and 2 during day and evening periods, except the Water Reference Library which is only open during the day.

Staff and students must use a machine-readable identification card to borrow from the main University Library. Personal identification is required in the other libraries listed. For students a current Union card is acceptable. Staff must apply to the Library for a library card.

New students can collect temporary borrowing cards at the Library in Orientation Week. It is recommended that students attend the *Introduction to the Library* held during Orientation Week and the first week of Session 1.

Specific library problems should be referred to the Reader Assistance Unit located in the foyer of the Library. Copies of the *Library Guide* are available on request.

Accommodation

There are seven **residential colleges** on campus which offer accommodation to male and female students. The philosophy of the management, the residence fees and facilities vary from college to college. In addition to the basic fees charged most colleges make additional minor charges such as a registration fee and a power charge. It is anticipated that the fees in most colleges will be increased for 1976. Assistance is also provided in finding **off-campus accommodation.**

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

International House International House accommodates over 120 students from Australia and twenty other countries. Preference is given to more senior undergraduates and graduate students. Apply in writing to the Warden, International House, PO Box 88, Kensington, NSW 2033.

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

Shalom College Shalom College provides accommodation for 86 men and women students. Non-resident membership is available to students who wish to avail themselves of the Kosher dining room and tutorial facilities. Apply in writing to the Master, Shalom College, The University of New South Wales, PO Box 1, Kensington, NSW 2033.

Warrane College An affiliated Roman Catholic residential college, Warrane provides accommodation for 200 men students, both graduate and undergraduate. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. Fees are payable on a session basis. Apply in writing to the Master, Warrane College, PO Box 123, Kensington, NSW 2033.

Off-campus Housing The Student Amenities and Recreation Unit maintains an up-to-date record of different types of off-campus housing including hostels, full board, bed and breakfast, flats and houses for rent. For information and assistance apply to the Housing Officer, Hut B, at the foot of Basser Steps (extension 3260).

Student Employment

The Student Employment Unit offers assistance with career employment for final year students and graduates of the University. This service includes the mailing of regular job vacancy notices to registered students and a campus interview program for final year students.

Careers advice and assistance is also available to undergraduates. Assistance is offered in finding vacation employment which gives either course-related experience or industrial training experience, where this is a course requirement. Information and advice regarding cadetships, undergraduate and graduate scholarships is also available.

The service is located in the Chancellery on the ground floor.

Phone extension 3259 for employment and careers advice, or extension 2086 for cadetships and industrial training information.

Student Health

The Student Health Unit, staffed by qualified medical personnel, offers free medical and first-aid services to male and female students. The service is not intended to replace private or community health services and thus if chronic or continuing conditions are revealed or suspected you will be advised and referred to your own doctor or an appropriate hospital. The health service is not responsible for fees incurred in these instances. Confidential appointments can be made at Hut E at the foot of Basser Steps between 9 am and 5 pm Monday to Friday. Phone extension 2679 or 3275.

Student Counselling and Research

The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, undergraduate and graduate. If you have any personal needs, worries or confusion use this free, informal, personal service to help you sort out the basic issues. If the counsellor can't help you himself he usually knows someone who can.

Counselling appointments are available during sessions and recesses between 9 am and 7 pm. Phone 663 0351 extensions 2696 and 2600 to 2605, or call during Unit office hours, 8.30 am to 5.30 pm. Urgent interviews are possible on a walk-in basis between 9 am and 5 pm. Group counselling programs are offered both day and evening between 9 am and 9 pm by special arrangement.

Student Amenities and Recreation

This Unit, working in close liaison with the Sports Association, assists various recognized clubs by arranging and providing facilities and by handling on their behalf all inquiries and applications for membership.

It also provides a recreational program for students and staff at the Physical Education and Recreation Centre; liaises with the Public Transport Commission of New South Wales on matters concerning student travel concessions; and assists students in finding suitable accommodation off the campus.

Concessional application forms for all types of travel may be obtained at the Student Amenities and Recreation Unit or at the Information Desk in the Chancellery.

The Student Amenities and Recreation Unit is located in Hut B at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Sports Association, 2235; Physical Education and Recreation Centre, 3271; Travel, 2617; Accommodation, 3260.

Physical Education and Recreation Centre

The Physical Education and Recreation Centre consists of eight squash courts and a main building. The latter has a large gymnasium and ancillary practice rooms for fencing, table tennis, judo, weight-lifting and a physical fitness testing room. The Supervisor of Physical Recreation is responsible for the Centre and provides a recreational program for both students and staff. If you would like to take part in any of the programs contact the Supervisor on extension 3271.

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 $45 per year for all registered students and is open to all members of staff and graduates of the University.

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

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

The Students' Union

The Students' Union is run by students and represents them on and off campus. Presidential elections are by

popular vote and all students who have completed two years at the University are eligible for election.

Membership is compulsory at $10 per annum.

The activities of the Students' Union include:

1. Infakt—a student-run information referral service. If you want someone to talk to or need help of any kind see the people at Infakt located in the bus at the foot of Basser Steps.
2. A casual employment service.
3. Organization of Orientation Week.
4. Organization of Foundation Day.
5. A nursery/kindergarten, "The House at Pooh Corner".
6. Publication of the student paper "Tharunka".
7. A free legal service run by a qualified lawyer employed by the Students' Union Council.

The Students' Union is affiliated with the Australian Union of Students (AUS) which represents students on the national level.

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

Chaplaincy Centre

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

Student Clubs and Societies

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

The Sports Association The Sports Association caters for a variety of competitive sports for both men and women. Membership of the Association is compulsory for all registered students and the annual subscription is $6.

Details of sporting facilities are available in the Orientation Magazine, available at the Student Amenities and Recreation Unit (Hut B at the foot of Basser Steps).

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

Other Services and Activities

University Co-operative Bookshop Limited Membership is open to all students, on payment of a fee of $5, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

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

Australian Armed Forces Enquiries should be directed to:

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

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

Royal Australian Air Force: Undergraduates interested in the R.A.A.F. Undergraduate Scheme should contact The Recruiting Officer, Defence Forces Recruiting Centre, 320 Castlereagh Street, Sydney.

Financial Assistance to Students

Tertiary Education Assistance Scheme

Under this scheme, which is financed by the Australian Government, assistance is available as follows:

- for full-time study in approved courses
- subject to a means test
- on a non-competitive basis
- to students who are not bonded
- to students who are permanent residents of Australia.

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

- Undergraduate and graduate degree courses
- Graduate diplomas
- Approved combined Bachelor degree courses
- Master's qualifying courses where the course is the equivalent of an honours year and the student has not attempted an honours year.

Benefits

Means-tested Living Allowance The maximum rates of living allowances are $1,000 per annum for students living at home and $1,600 per annum for students living away from home. The maximum rates of living allowance will be paid where the adjusted family income is equal to *or* less than $7,600 per annum. The adjusted family income is assessed by subtracting from the gross income of both parents their business expenses and an amount of $450 for each dependent child other than the student.

When the adjusted family income exceeds $7,600 p.a. the amount of living allowance will be reduced by $2 for every $10 of income until the family income exceeds $15,200 per annum. After this level, the living allowance will be reduced by $3 for every $10 of income.

A concession may be made where there are other children in the family undertaking tertiary education with scholarship assistance from schemes other than the Tertiary Education Assistance Scheme of less than $600 pa.

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

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

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

Dependants' Allowance This is made up of allowances of $15 per week for a dependent spouse and $7 per week for each child.

How to Apply If you were a 1975 Higher School Certificate candidate or a tertiary student receiving an allowance, you were sent forms last October. Other students may obtain forms from the Admissions Section *or* the Student Employment and Scholarships Unit, *or* from the Regional Director, Department of Education, Central Square, 323 Castlereagh Street, Sydney, N.S.W. 2000 (Telephone 218 8800). The administrative closing date for 1976 applications was 31 October 1975.

Scholarships, Cadetships, Prizes

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

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

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

2 *Graduate Awards* An honours degree is generally an essential requirement for gaining one of the many graduate scholarships which are available at the University. Therefore gifted students should not neglect the opportunity to qualify for honours and thus become eligible for an award.

Details of graduate awards are contained in the University Calendar.

Other Financial Assistance

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

3 Early in 1973 the Australian Government made funds available to the University to provide loans to students in financial difficulty. The loans are to provide for living allowances and other approved expenses associated with attendance at University. Repayment usually commences after graduation or upon withdrawal from the course. Students are required to enter into a formal agreement with the University to repay the loan.

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

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

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

Financial Assistance to Aboriginal Students

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

All inquiries relating to this scheme should be made at the office of the Deputy Registrar (Student Services), Room 148A, in the Chancellery.

Rules and Procedures

The University, in common with other large organizations, has some agreed ways of doing things in order

to operate efficiently and equitably for the benefit of all members. The rules and procedures listed below will affect you at some time or another. In some cases there are penalties (e.g. fines or exclusion from examinations) for failure to observe these procedures and therefore they should be read with care.

The information is arranged as answers to questions most asked by students. The first group of questions concerns admission and enrolment, the second fees and other money matters, the third examinations, and the remainder more general matters such as student conduct on campus.

Admission and Enrolment

How do I qualify for admission? In order to enter an undergraduate course you must qualify for matriculation to the University; satisfy requirements for admission to the course of subjects chosen; and be selected for admission to the faculty or course you wish to enter. Full details of matriculation and admission requirements are contained in a pamphlet obtainable at the Admissions Office and in the Calendar.

All students, except those enrolling in graduate research degrees (see below), must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form.

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

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

New Undergraduate Enrolments Persons who are applying for entry in 1976 must lodge an application for selection with the Metropolitan Universities Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1975.

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

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

First Year Repeat Students First year students who failed more than half the programme at the 1975 Annual Examinations and who were not granted any deferred examinations should NOT follow the above procedure. They are required to *show cause* why they should be allowed to continue in the course, and should await instructions in writing from the Registrar as to the procedure.

Later Year Enrolments Students should enrol through the appropriate School in accordance with the procedures set out in the current year's booklet, *Enrolment Procedures*, available from the Admissions Office and from School offices.

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

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

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

Miscellaneous Subject Enrolments Students may be permitted to enrol for miscellaneous subjects (ie as students not proceeding to a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit to the student and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. A student who is under exclusion may not be enrolled in miscellaneous subjects which may be counted towards any course from which he has been excluded.

Final Dates for Completion of Enrolments No enrolments for courses extending over the whole year or for Session 1 only will be accepted from new students after the end of the second week of Session 1 (12 March 1976) except with the express approval of the Deputy Registrar (Student Services) and the Head of the School 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 (26 March 1976) without the express approval of the Deputy Registrar (Student Services). No enrolments for courses occupying Session 2 only will be accepted after the end of the second week of Session 2 (30 July 1976) without express approval of the Deputy Registrar (Student Services).

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

What special rules apply if I wish to be considered for admission with advanced standing? If you make application to register as a candidate for any degree or other award granted by the University you may be admitted to the course of study with such standing on the basis of previous attainments as may be determined by the Professorial Board. For complete details regarding "Admission with Advanced Standing" consult the University Calendar.

What happens if I am unable to pay fees at the time of enrolment? If you are unable to pay fees by the due date you may apply in writing to the Deputy Registrar (Student Services) for an extension of time which may be granted in extenuating circumstances.

What happens if I fail to pay the prescribed fees or charges? If you fail to pay prescribed fees or charges or become otherwise indebted to the University and you fail to make a satisfactory settlement of your indebtedness upon receipt of due notice then you cease to be entitled to the use of University facilities. You will not be permitted to register for a further session, to attend classes or examinations, or be granted any official credentials. In the case of a student enrolled for Session 1 only or for Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (23 April 1976). 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 (27 August 1976).

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

Can I transfer from one course to another? To transfer from one course to another you must apply on an application form obtainable from the Admissions Office by 16 January. If your application is successful you are required to comply with the enrolment procedures for the year/stage of the new course and, unless otherwise instructed, you should present the letter granting transfer to the enrolling officer. You should also inform the enrolling officer of the school in which you are enrolled of your intention to transfer.

Can I change my course program? If you wish to seek approval to substitute one subject for another, add one or more subjects to your program or discontinue part or all of your program, you must make application to the Registrar through the Head of the School responsible for the course on forms available from the School office. The Registrar will inform you of the decision. Application to enrol in additional subjects must be submitted by the end of the fourth week of Session 1.

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

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

First Year Students

1. one-session subjects: the end of the eighth week of session;

2. double-session subjects: the end of the second week of Session 2.

For the purpose of this rule a first-year student is defined as one who is attending the University for the first time either on a full- or part-time basis and is enrolled in the first year or first stage of a course.

Other Students

1. one-session subjects: the end of the fourth week of session;

2. double-session subjects: the end of the May Recess.

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

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

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

First-year Rule

1. A student enrolled for the first time in any undergraduate course in the University shall be required to

show cause why he/she should be allowed to continue the course if that student fails more than half the program in which he/she is enrolled. In order that students may calculate half their program, the weighting of subjects in each course is defined in *Schedule A*,* which may be varied from time to time by the Professorial Board.

Repeated-failure Rule

2. A student shall be required to show cause why he/she should be allowed to repeat a subject which that student has failed more than once. *Where the subject is prescribed as part of the student's course he/she shall also be required to show cause why he/she should be allowed to continue that course.* Failure in a deferred examination as well as in the initial examination counts for the purposes of this rule as one failure.

General Rule

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

The Session-unit System

4. **A** A student who infringes the provisions of Rules 1 or 2 at the end of Session 1 of any year will not be required to *show cause* at that time but will be allowed to repeat the subject(s) (if offered) and/or continue the course in Session 2 of that year, subject to the rules of progression in that course.

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

Exemption from Rules by Faculties

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

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

'Showing Cause'

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

B Each application shall be considered by the Re-enrolment Committee which shall determine whether the cause shown is adequate to justify the granting of permission to re-enrol.

Appeal

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

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

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

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

The decision of the Committee shall be final.

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

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

Exclusion

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

* For details of Schedule A see University Calendar.

* It is proposed that under this arrangement, the membership of the Appeal Committee will be Pro-Vice-Chancellor J. B. Thornton (Chairman), Professor D. M. McCallum, Chairman of the Professorial Board, and a member of Council in the category of members elected by the graduates of the University, nominated by the Vice-Chancellor.

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

C A student excluded from a course or courses under the provisions of **A** or **B** may not enrol as a miscellaneous student in subjects which may be counted towards any such course.

Re-admission after Exclusion

9. A An excluded student may apply to the Re-enrolment Committee for re-admission after two academic years.

B An application for re-admission after exclusion should be made on the form available from the Examinations and Student Records Section and should be lodged with the Registrar not later than 31 August in the year prior to that for which re-admission is sought. A late application may be accepted at the discretion of the University.

C An application should include evidence that the circumstances which were deemed to operate against satisfactory performance at the time of exclusion are no longer operative or are reduced in intensity and/or evidence of appropriate study in the subject(s) (or the equivalent) on account of which the applicant was excluded.

Restrictions and Definitions

10. A These rules do not apply to students enrolled in programs leading to a higher degree or graduate diploma.

B A subject is defined as a unit of instruction identified by a distinctive subject number.

How do I apply for admission to degree or diploma? Applications for admission to a degree or diploma of the University must be made on the appropriate form by 12 September, in a student's final year. Forms are mailed to all final year students. Don't forget to inform the University if you subsequently change your address so that correspondence related to the ceremony will reach you without delay. Applicants should ensure that they have completed all requirements for the degree or diploma, including industrial training where necessary. Any variation such as cancelling of application in order to proceed to an honours degree or submission of an application following discontinuation of honours program, must be submitted in writing to the Registrar no later than 30 January.

Fees*

Do I have to pay fees for tuition? No. There are no fees for tuition but other fees and charges are payable.

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

How much is my contribution to student activities and services on campus? All students (with the exceptions noted below) will be required to pay the following fees if enrolling for a program involving two sessions. Those enrolling for only one session will pay one-half of the Student Activities Fees, but the full University Union entrance fee, if applicable.

University Union entrance fee—$20 payable on first enrolment

Students Activities Fees:

University Union—$45 annual subscription

Sports Association—$6 annual subscription

Students' Union:

Students enrolling in full-time courses—$10 annual subscription

Students enrolling in part-time courses—$8 annual subscription

Miscellaneous—$25 annual fee.

(The miscellaneous fee is used to finance expenses generally of a capital nature relating to student activities. Funds are allocated to the various student bodies for projects recommended by the Student Affairs Committee and approved by the University Council.)

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

Pathology Instrument Kit—$10
(Refundable on return in satisfactory condition)

Who is exempt from payment of fees?

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

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

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

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

4. Students who while enrolled at another university in Australia in a degree or diploma course are given approval to enrol at the University of New South Wales but only in a miscellaneous subject or subjects to be credited towards the degrees or diplomas for which they are enrolled elsewhere are exempt from all Student Activities Fees and the University Union entrance fee.

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

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

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

How much will textbooks and special equipment (if any) cost? You must allow quite a substantial sum for textbooks. This can vary from $200 to $600 depending on the course taken. These figures are based on the cost of new books. The Students' Union operates a second-hand bookshop. Information about special equipment costs, accommodation charges and cost of subsistence on excursions, field work, etc., and for hospital residence (medical students) are available from individual schools.

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

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

What penalties exist for late payment of fees? The following additional charges will be made **in 1976** when fees are paid late:

Failure to lodge enrolment form according to enrolment procedure	$20
Payment of fees after end of second week of session	$20
Payment of fees after end of fourth week of session	$40

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

Yes. The following rules apply:

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

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

Examinations

When are examinations held? Most annual examinations are held in November-December but examinations in many subjects are also held during the Midyear Recess.

Provisional timetables indicating the dates and times of examinations and notices of the location of examinations are posted on the central notice boards in the Biological Sciences Building, the Chancellery, Central Lecture Block, Dalton Building (Chemistry), Main Building (Mining and Physics), and in the Western Grounds Area on 4 May and 21 September. You must advise the Examinations Unit (Chancellery) of a clash in examinations by 17 May and 1 October. Final timetables are displayed and individual copies are available for students on 1 June and 19 October.

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

In the assessment of your progress in University courses, consideration is given to work in laboratory and class exercises and to any term or other tests given throughout the year as well as to the results of written examinations.

How are examination passes graded? Passes are graded: High Distinction, Distinction, Credit and Pass. A Pass Conceded may be granted to a student whose mark in a subject is slightly below the standard required for a pass but whose overall satisfactory performance warrants this concession.

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

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

Can examination results be reviewed? Examination results may be reviewed for a fee of $11 a subject, which is refundable in the event of an error being discovered.

This review consists mainly of ensuring that all questions attempted have been marked and checking the total of the marks awarded. Applications for review must be submitted on the appropriate form to the Examinations and Student Records Section together with the necessary fee by the following dates:

Annual examinations held in November/December 1976 —Friday 7 January 1977.

Deferred examinations held in January/February 1977 —Tuesday 22 February 1977.

Are allowances made if students are sick before or during an examination? A student who through serious illness or other cause outside his control *is unable to attend an examination* is required to bring the circumstances (supported by a medical certificate or other evidence) to the notice of the Registrar *not later than seven days after the date of the examination*, and may be required to submit to medical examination.

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

All medical certificates should be as specific as possible concerning the severity and duration of the complaint and its effect on the student's ability to take the examinations.

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

A student suffering from a physical disability which puts him at a disadvantage in written examinations should apply to the Registrar in writing for special provision when examinations are taken. The student should support his request with medical evidence.

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 under special circumstances.

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

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

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

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

4. No candidate shall be admitted to an examination after thirty minutes from the time of commencement of the examination.

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

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

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

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

9. All answers must be in English unless otherwise directed. Foreign students who have the written approval of the Officer-in-Charge of Examinations may use standard translation dictionaries.

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.

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

Under what circumstances are deferred examinations granted? Deferred examinations may be granted in the following cases:

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

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

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

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

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

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

Can I buy copies of previous examination papers? Yes—for 5c each from the Union Shop in the University Union.

Student Conduct on Campus

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

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

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

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

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

If you fail a subject at the annual examinations in any year and re-enrol in the same course in the following year, you must include in your program of studies for that year the subject in which you failed. This requirement will not be applicable if the subject is not offered the following year; 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.

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

Why is my University Union card important? All students are issued with a University Union membership card. Your card must be carried during attendance at the University and shown on request.

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

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

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

New students will be issued with University Union cards on enrolment.

Why should I inform the University if I change my address? If you change your address you should notify the Student Records Section of the Registrar's Division as soon as possible. Failure to do this could lead to important correspondence (including examination results) not reaching you. The University cannot accept responsibility if official communications fail to reach students who have not notified their change of address. Change of Address Advice Forms are available at Faculty and School offices and at the Information Counters on the Ground Floor of the Chancellery Building.

These will be accepted up to 30 November, except for final year students who may advise changes up to four weeks before their graduation ceremony.

Will the University release information to third parties without my permission? In general, no. The University treats examination results and information it receives from a student as confidential and will not reveal such information to third parties without the permission of the student except at the discretion of senior officers in circumstances considered of benefit to the student and when it is either impossible or impracticable to gain the student's prior permission. This happens rarely. This policy is considered so important that it often involves officers of the University in very difficult situations, for example, when they must refuse to reveal the address of a student to parents or other relatives.

In spite of the policy, there are sometimes accusations made that the University has revealed information, including addresses (especially to insurance companies). All students should be aware that students' addresses are eagerly sought by various commercial agents and that sometimes tricks are used to obtain them. For example, from time to time people claiming to be from the University telephone students or their families and ask for information (usually another student's address) which is often given, unsuspectingly. There is evidence that this is a technique used by commercial agents.

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

How are student records kept up to date? Enrolment details forms will be sent to all students on 26 April and 30 August. It is not necessary to return these forms unless any information recorded thereon is incorrect. Amended forms must be returned to the Examinations and Student Records Section within fourteen days. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Amended forms returned to the Registrar will be acknowledged in writing. within fourteen days.

Is there any rule related to the ownership of students' work? Yes. The University reserves the right to retain at its own discretion the original or one copy of any drawings, models, designs, plans and specifications, essays, theses or other work executed by you as part of your courses, or submitted for any award or competition conducted by the University.

Can I get a permit to park on campus? Because of the limited amount of parking space available, only the following categories of students may apply for a permit: motor cycle owners (annual fee $3.90; masters and doctoral candidates (ballotted issue, annual fee $7.80); graduate, and senior undergraduate students who have completed two or three years of a full-time or part-time course (annual fee $3.90—only a limited number of permits available for students who have completed two years). A permit will allow access to the campus between 5 pm and 11 pm on weekdays and during library hours on Saturdays, Sundays and public holidays. Enquiries should be made to the Property Section, Room 240, the Chancellery, or phone 663 0351, extension 2920. It should be noted that increasing demand for parking space may require the imposition of further restrictions and that rates may change for 1976.

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

Further Information

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

General

Any student who requires information on the application of these rules or any service which the University offers, may make enquiries from the Admissions Office, the Student Counselling Unit or the Registrar.

Admissions Office

The Admissions Office provides students with information concerning courses, admission requirements and enrolment procedure.

It will receive applications from students who wish to defer or resume courses of study, to transfer from one course to another, or seek any concession in relation to a course in which they are enrolled.

These applications should, wherever possible, be lodged before the beginning of the academic year in which the concession is to apply.

Students in doubt as to whether an application is necessary to cover their own particular situation should enquire at the Admissions Office.

The Admissions Office is located in the Chancellery on the upper campus. Office hours are from 9 am to 1 pm and 2 pm to 5 pm. Monday to Friday. An evening service is provided during the enrolment period.

Notices

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

Appeals

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

The Calendar

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

Foreword

This handbook is primarily for undergraduate students in the Faculty of Engineering and aims to provide information concerning the requirements for admission, enrolment and re-enrolment, conditions for the award of the different Bachelor degrees in the Faculty and the subject matter of the courses offered, including textbooks. *It is important that each student in the Faculty becomes well acquainted with the information presented here.* In addition to this Handbook, pamphlets and brochures issued in conjunction with the enrolment period and Orientation Week are available. These should be consulted, together with the University Calendar, for further information on problems associated with courses.

At the same time, it is appreciated that a student's choice in regard to course and other matters remains to be discussed with members of the academic staff. Some students do not need to make their final choice of degree course before the start of third year. Students should consult the Heads of Schools about this; where the Heads cannot be available, they have nominated colleagues to deal with enquiries.

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

Skills

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

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

Communication

- The ability to direct and manage engineering activities.

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

Creativity

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

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

We hope to do much more than merely impart a body of knowledge to our undergraduates. Appropriate attitudes and skills for professional engineers operating into the twenty-first century must also be developed. Technology has come under increasing criticism from other sectors of society. It is no longer accepted that advances in technology are necessarily synonymous with the betterment of society, and future engineers must be prepared not only to take account of the ramifications of their work, but also to vindicate them to an increasingly doubtful public. Good opportunities exist for this in *Faculty Hour*, a voluntary series of lectures and discussions on topics touching on the interaction of the engineer and society. This takes place at noon on Mondays in the Electrical Engineering Theatre LG1. All third and fourth year students, and some others also, will find their timetables free of formal classes at noon on Mondays. Students are urged to use Faculty Hour to broaden their approach to their studies.

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Faculty of Engineering

Staff

Comprises Schools of Civil, Electrical, Highway, Mechanical and Industrial, Nuclear, Surveying, and Transportation and Traffic.

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Chairman
Professor T. K. Hogan

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Executive Assistant to Head of School
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Administrative Officer
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Department of Water Engineering

Includes Hydraulics, Hydrology, Public Health Engineering, Water Resources Engineering, and the Water Research Laboratory.

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

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Colin Raymond Dudgeon, ME *N.S.W.*, MIEAust
Trevor Regis Fietz, ME *N.S.W.*, MIEAust
Douglas Neil Foster, BE *Syd.*, MIEAust
David Trewhella Howell, BE *Syd.*, ME *N.S.W.*, MIEAust, MAIAS
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Lecturers
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David Lyon Wilkinson, BE *Syd.*, PhD *N.S.W.*

Tutor
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Professional Officers
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Jonathan Keith Tuck, BE *N.S.W.*

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

Department of Civil Engineering Materials

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

Associate Professors
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Alan Frank Stewart Nettleton, BSc BE *Syd.*, ME *N.S.W.*, DIC
Geoffrey Baldwin Welch, BE *Syd.*, ME *N.S.W.*, CEng, MICE, FIEAust

Senior Lecturers
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Esca Morrice Kitchen, BE *Syd.*, MIEAust
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Lecturers
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Dudley Robert Morgan, BSc(Eng) *Rand.*, MSc *Calg.*, PhD *N.S.W.*
Harry Taylor, BSc(Eng) *Birm.*, DipNA & AC *Syd.*
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Stephen Ross Yeomans, BSc *N.S.W.*

Teaching Fellows
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Hinrich Nicolaus Lunsmann, BE *N.S.W.*, ASTC, GradIEAust
Ghodratollah Tamaddoni, BEngAg *Tehran*, DAgASc *Gembloux*, Dipl *T.H.Delft*

Department of Structural Engineering

Includes Structures, Stress Analysis and Solid Mechanics.

Associate Professors
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PhD *Northwestern*
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Department of Engineering Construction and Management

Includes Systems Engineering, Engineering Economy, Project Planning and Management.

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Lecturers
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Neville Waller Rees, BSc PhD *Wales*

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Professor of Electrical Engineering
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Visiting Professor—Solid State Electronics
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Tyree Professor of Electrical Engineering—Electric Power Engineering
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Department of Electric Power Engineering

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Boris Osman, BE *Adel.*, FSASM, MIEAust
Hugh Lithgow Stark, BSc PhD *Strath.*, CEng, MIMechE, MIEAust
Jae Lin Woo, BSc *Seoul*, SM *M.I.T.*

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David Malcolm Jenkins, BE *Syd.*
Lyle John McLean, BScEng *N.S.W.*, GradIEAust
Hoong Gheow Wong, BE *N.S.W.*

Department of Fluid Mechanics and Thermodynamics

Includes Aeronautical Engineering and Naval Architecture.

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Department of Agricultural Engineering

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Department of Industrial Engineering

(including Operations Research and Production Engineering)

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Daniel Goodridge, DiplIngChim *L'Aurore, Shanghai*, DiplndEng *N.S.W.*
Thomas Richard Jefferson, MSc *Tor.*, PhD *Northwestern*
Grier Cheng Lin, DipMechEng *P.T.I.T., Taiwan*, PhD *N.S.W.*, MIEAust
Raymond Norman Roth, BE PhD *N.S.W.*, CEng, MIEAust
Carlton Henry Scott, BSc *Qld.*, PhD *N.S.W.*
Graham Smith, BE MEngSc *N.S.W.*, ASTC, MIEAust

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Walter Dollar, ASTC
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Philip Henry Sivyer, BE *N.S.W.*, MIEAust
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Ching Yin Lim, BE *N.S.W.*
Do Le Minh, BE *N.S.W.*
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Simandiri, MEngSc *N.S.W.*
Hadi Winarto, BE *Syd.*, MEngSc *N.S.W.*, GradIEAust

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Teaching Fellow
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Professional Officer
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Professor of Surveying and Head of Department of Photogrammetry
Robert Brewster Forrest, D.Geod.Sci. *Ohio State*, BA *Minn.*

Associate Professor of Surveying and Head of Department of Surveying
George Gordon Bennett, MSurv *Melb.*, PhD *N.S.W.*, LS(N.S.W.), FISAust

Administrative Assistant
Joseph Valentine Fonseka, BA *Lond.*

Department of Geodesy

Associate Professor
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Lecturers
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Arthur Stolz, BSurv PhD *N.S.W.*, LS(N.S.W.), MISAust
Friedrich Karl Brunner, DipIng Dr techn T.H. *Vienna*, MISAust

Department of Photogrammetry

(including Land Studies and Cartography)

Senior Lecturers
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Bruce Crosby Forster, MSurv *Melb.*
George James Forster Holden, ARICS, DipPhoto. *Lond.*, PhD *N.S.W.*, FRGS, MISAust, MAIC

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

Senior Tutor
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Teaching Fellow
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Department of Surveying

Associate Professor
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Senior Lecturer
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Lecturers
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Sabapathy Ganeshan, BSc *Ceyl.*
Klaas Ids Groenhout, BSurv *N.S.W.*, LS(N.S.W.), AISAust, AMAIC
Gregory Justin Hoar, BSurv PhD *N.S.W.*, MISAust
Jean Mark Rueger, DipIng. ETH *Zurich*

Senior Tutor
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Warren William Kent, BSurv *N.S.W.*

School of Transportation and Traffic

Professor of Traffic Engineering and Head of School
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Harold James Arthur Turner, BSc *Lond.*, ME *N.S.W.*, MIEE, ARCS

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

Senior Project Scientist
Alex James Fisher, BSc *Lond.*

Professional Officers
Roger Roy Hall, BSc *A.N.U.*
Colin John Wingrove, BSc *N.S.W.*

The Faculty of Engineering

The Faculty consists of seven Schools: Civil Engineering, Electrical Engineering, Highway Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, Surveying, and Transportation and Traffic.

School of Civil Engineering

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

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

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

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

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

School of Electrical Engineering

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

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

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

School of Highway Engineering

Graduate courses are offered, leading to the degree of Master of Engineering Science and to a Postgraduate Diploma, in which road location and geometrics, properties of road materials, construction techniques, bridge design and traffic engineering are studied.

The School has well-equipped laboratories for studying the properties of soils, road aggregates, bitumen and cement concrete, and active studies on these subjects are in progress. Members of the School use a 1620 IBM computer as part of their course, and studies are being made of its utilization in all phases of highway engineering. They also have access to a very large central computing network.

School of Mechanical and Industrial Engineering

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

The first two years of the full-time degree, and the first four stages of the part-time degree are common to all courses within the School. Thus a final decision on the discipline to be followed need not be made until the end of Year 2 for full-time and Stage 4 for part-time students.

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

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

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

School of Nuclear Engineering

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

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

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

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

School of Surveying

The School of Surveying offers a full-time course and a sandwich course leading to the degree of Bachelor of Surveying. The full-time course is of 4 years duration while the sandwich course may be completed in 6 or 7 years. Until 1975, a part-time evening course of 7 years' duration was also available but this is now being phased out and replaced by the sandwich course. The graduate courses offered are Master of Surveying Science, a two year part-time or one year full-time course; and the research degrees Master of Surveying and Doctor of Philosophy.

The School is located in the Civil Engineering Building. Facilities include four Photogrammetry laboratories with plotting instruments of various types, an observing platform for Positional Astronomy and a comprehensive range of field equipment for Surveying and Geodesy. Computing facilities include programable calculators and a library of programmes for use on the University's computers.

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

School of Transportation and Traffic

The School of Transportation and Traffic is located at Randwick, and is associated with the School of Highway Engineering.

The establishment of the School followed the endowment of a Chair by the Australian Automobile Association, which had long been concerned with the need for a centre for training traffic engineers and specialists. The School is assisting this object by conducting courses in traffic and transport planning and control, and offering opportunities for research into the technical problems created by the motor vehicle and other forms of transport and on their interaction with land use activity.

The research activities of the School cover a wide range of transport and traffic phenomena, viz. traffic flow theory—queueing, traffic stream structure, saturation flow, transportation planning—land use and transport interaction, system parameters, synthetic models for growth, distribution and assignment of desire lines; public enterprise economics; and human factors and road safety. Research in these fields can be undertaken for the ME, MSc, and PhD degrees. Formal courses, one year full-time and two years part-time, leading to the degree of Master of Engineering Science are also offered in Transport and Traffic. A part-time Transport graduate course offered over four sessions leads to a Graduate Diploma.

In addition to the academic research activities the School has an Applied Research Division which undertakes project research for national bodies and institutions.

Faculty Information

Faculty of Engineering Course Advisory Centre

The Faculty of Engineering is participating in the Course Advisory Centre which is located in Unisearch House. Members of Academic Staff are available to advise students about careers in the various fields of engineering and about undertaking a course in engineering in this university. The Centre opens from 10.00 am to 4 pm (closed 12 noon to 2 pm) from Wednesday 7 January to 9 January, 1976. (663 0351, Extn. 2218.) Prospective students are advised to take advantage of this facility.

Faculty of Engineering Enrolment Procedures

Preliminary Enrolment

Courses in Aeronautical, Industrial, Mechanical Engineering and Naval Architecture.

Students in the above courses should have received a form requesting them to nominate their choice (choices) of General Studies Electives, and Technical Electives where applicable.

If any student has not received the above form he should obtain it from the School's General Office, complete it and return it to the General Office before the end of lectures in Session 2.

Since this booklet contains all other necessary information no further enrolment instructions will be sent through the mail.

Course in Civil Engineering and Course in Surveying
Students should obtain enrolment information and a form to nominate General Studies and Technical Electives from the School Office before end of lectures, Session 2.

Course in Electrical Engineering
By the end of Session 2 students must obtain their personal Enrolment Form, the Proposed Program Form EE76, information sheet and timetable from the School Office. After results are notified, the Proposed Program Form and Enrolment Form (completed as far as possible) should be forwarded to the School Office by Friday 16 January. Completion of enrolment takes place in February with attendance at the enrolment centre.

School of Civil Engineering

Enrolment Timetable

1. Full-time Courses

A. Students progressing into a complete year as shown in the Handbook.

Year 2	Friday 20 February
Surnames A to M	9.00 am to 11.00 am
Surnames N to z	11.00 am to 1.00 pm
Year 3	Thursday 19 February
Surnames A to M	9.00 am to 11.00 am
Surnames N to Z	11.00 am to 1.00 pm
Year 4	Tuesday 17 February
Surnames A to M	9.00 am to 11.00 am
Surnames N to Z	11.00 am to 1.00 pm

B. Students with *broken* programs NOT progressing into a complete year, as shown in the Handbook.

Year 2	Thursday 26 February
Surnames A to M	9.30 am to 11.00 am
Surnames N to Z	11.00 am to 12.30 pm
Year 3	Wednesday 25 February
Surnames A to M	9.30 am to 11.00 am
Surnames N to Z	11.00 am to 12.30 pm
Year 4	Monday 23 February
Surnames A to M	9.30 am to 11.00 am
Surnames N to Z	11.00 am to 12.30 pm

2. Part-time Courses

A. Students progressing into a complete stage as shown in the Handbook.

Stages 2, 3, 4, 5 and 6	Thursday 19 February 2.00 pm to 5.00 pm 6.00 pm to 8.00 pm

B. Students with *broken* programs NOT progressing into a complete stage as shown in the Handbook.

Stages 2, 3, 4, 5 and 6	Wednesday 25 February 2.00 pm to 4.30 pm 6.00 pm to 8.00 pm

3. New Students with Advanced Standing

Thursday 26 February
6.00 pm to 8.00 pm

General Studies

Students enrolling in general studies electives after completing enrolment in their own Faculty and BEFORE GOING TO THE CASHIER, should proceed to the General Studies enrolment centre in Unisearch House where they will obtain places in electives, complete class admission cards and finalize enrolment forms.

Enrolment Centre

1. Students progressing into a complete stage or year as shown in the Handbook.	Room 109 School of Civil Engineering
2. Students with *broken* programs NOT progressing into a complete stage or year as shown in the Handbook and Part-time New Students with Advanced Standing.	Unisearch House 221 Anzac Parade (across from Main Campus)
3. Full-time New Students with Advanced Standing	Room 407 School of Civil Engineering

School of Electrical Engineering

Enrolment Timetable

Students should attend the appropriate enrolment centre according to the timetable below and enrol in the approved program.

1. Full-time Courses

Year 1 repeats and Year 2 students	Thursday 26 February 2.00 pm to 4.30 pm
Year 3	Tuesday 24 February 2.00 pm to 4.30 pm
Year 4	Monday 23 February 9.30 am to 12.30 pm

2. Part-time Courses

Students re-enrolling at all stages	Wednesday 25 February 6.00 pm to 8.00 pm

3. New Students with Advanced Standing

Friday 27 February
9.30 am to 12.30 pm

General Studies

Students enrolling in general studies electives after completing enrolment in their own Faculty and BEFORE GOING TO THE CASHIER, should proceed to the General Studies enrolment centre in Unisearch House where they will obtain places in electives, complete class admission cards and finalize enrolment forms.

Enrolment Centre

Re-enrolling students	Unisearch House 221 Anzac Parade (across from Main Campus)
New students with advanced standing	Room G1 Electrical Engineering Building

School of Mechanical and Industrial Engineering

Enrolment Timetable

Unless otherwise indicated students enrolling in the courses offered by the School are required to attend Room 106 in the School's Building in accordance with the following timetable:

1. Full-time Courses

Year 2 and Year 1 repeats	Monday 23 February 2.00 pm to 6.00 pm
Year 3	Tuesday 24 February 9.00 am to 12 noon

Year 4	Monday 23 February 9.00 am to 12 noon

2. Part-time Courses

Stages 2, 3 and Stage 1 repeats	Monday 23 February 2.00 pm to 6.00 pm
Stages 4, 5 and 6	Tuesday 24 February 2.00 pm to 5.00 pm 6.00 pm to 8.30 pm

3. New Students with Advanced Standing

Friday 27 February
2.00 pm to 5.00 pm

4. *Note:* To avoid congestion during Enrolment Week, students enrolling in years 2 to 4 full-time and stages 3 to 6 part-time who are not subject to Show Cause Rules or awaiting results of deferred examinations may complete their enrolment early in February. Students wishing to enrol early should make an appointment at the School's General Office commencing 20 October 1975.

General Studies

Students enrolling in general studies electives after completing enrolment in their own Faculty and BEFORE GOING TO THE CASHIER, should proceed to the General Studies enrolment centre in Unisearch House where they will obtain places in electives, complete class admission cards and finalize enrolment forms.

Enrolment Centre

Room 106
School of Mechanical and Industrial Engineering Building

School of Surveying

Enrolment Timetable

1. Full-time Courses

Year 2	Monday 23 February 9.30 am to 12.30 pm
Year 3	Tuesday 24 February 9.30 am to 12.30 pm
Year 4	Friday 27 February 9.30 am to 12.30 pm

2. Part-time Courses

Students re-enrolling at all Stages	Wednesday 25 February 2.00 pm to 6.00 pm

3. New Students with Advanced Standing

Full-time	Tuesday 24 February 9.30 am to 12.30 pm
Part-time	Wednesday 25 February 2.00 pm to 6.00 pm

General Studies

Students enrolling in general studies electives after completing enrolment in their own Faculty and BEFORE GOING TO THE CASHIER, should proceed to the General Studies enrolment centre in Unisearch House where they will obtain places in electives, complete class admission cards and finalize enrolment forms.

Enrolment Centre

7th Floor
Civil Engineering Building

Enrolment in Miscellaneous Subjects
(Students not proceeding to a degree or diploma)

Students may be accepted for enrolment in miscellaneous subjects provided the University considers that the subject/s will be of benefit to the student and there is accommodation available. Only in exceptional circumstances will subjects taken in this way count towards a degree or diploma.

Students seeking to enrol in miscellaneous subjects should obtain a letter of approval from the Head of the appropriate School or his representative permitting them to enrol in the subject concerned. The letter should be given to tne enrolling officer at the time of enrolment.

Students who have obtained written permission to enrol may attend the Unisearch House enrolment centre on

Friday 27 February
9.30 am to 12.30 pm

or they may enrol by attending the Admissions Office, Chancellery, at the times shown below.

Week Commencing 1 March	Monday to Friday 9.30 am to 1.00 pm 2.00 pm to 4.30 pm 5.30 pm to 7.00 pm
Week commencing 8 March	Monday to Friday 9.30 am to 1.00 pm 2.00 pm to 4.30 pm Wednesday and Friday 5.30 pm to 7.00 pm

School of Electrical Engineering

Persons who wish to obtain a letter of approval to enrol as *Miscellaneous Students in graduate subjects in the School of Electrical Engineering* are required to attend Room G3, School of Electrical Engineering, on Friday 20 February, 2.00 pm to 5.00 pm and 6.00 pm to 8.00 pm.

School of Civil Engineering

Students who wish to obtain a letter of approval to enrol as *Miscellaneous Students in graduate subjects in the School of Civil Engineering* are required to attend Room 109, School of Civil Engineering, on Friday 20 February, 9.30 am to 11.30 am and 6.00 pm to 8.00 pm.

Students who wish to obtain a letter of approval to enrol as *Miscellaneous Students in undergraduate subjects* should attend the School Office on Friday 27 February, 9.30 am to 11.30 am.

Late Enrolments

Students are strongly advised to attend for enrolment *during Enrolment Week* as those who fail to do so not only miss initial classes but disrupt lecture, tutorial and practical work programs and cause considerable inconvenience to lectures and the punctual students.

There are two late enrolment sessions:

First Late Enrolment Period

Wednesday 3 March

Second Late Enrolment Period

Wednesday 10 March

The times and locations for late enrolment in the Faculty of Engineering are shown below:

Faculty of Engineering Civil Engineering	School Office, 4th Floor Civil Engineering Building 5.00 pm to 7.00 pm
Surveying	Room 112, Civil Engineering Building By arrangement with the School
Electrical Engineering	School Office, Room G1 Electrical Engineering Building 5.00 pm to 7.00 pm
Mechanical, Aeronautical, Industrial Engineering and Naval Architecture	Room 103 School of Mechanical and Industrial Engineering 5.00 pm to 7.00 pm

Location of Laboratories outside Kensington Campus

Randwick

The Schools of Highway and Transportation and Traffic and the Structures Laboratory of the School of Civil Engineering occupy new buildings on the site of the old Tramway Depot at King Street, Randwick.

Manly Vale

The Water Research Laboratory of the School of Civil Engineering.

The Undergraduate Society of Engineers

All engineering students are automatically members of the Undergraduate Society of Engineers (USE) on enrolment in the faculty. The USE Committee, elected annually at the General Meeting, is responsible for the administration of the society.

The committee organizes numerous social and sporting events and prints NODUS, the newspaper for engineering students. In addition, it is asked to nominate students to sit on education committees, visiting committees and other associated bodies, which provide a valuable forum for student opinion on a wide range of topics.

The General Meeting is usually held in about the third week of Session 1 and students are encouraged to attend.

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

IAESTE is an organization to facilitate overseas work in technical areas in 48 different countries throughout the world for students or recent graduates. It organizes visas, work periods for as little as a 6 week holiday up to 12 months; lodging and an initial welcome.

In Australia IAESTE has a permenent Executive Director, and volunteer local committees made up of interested students at each university. At the University of New South Wales the local committee is associated with the Undergraduate Society of Engineers.

For more information write to the Executive Director at Australian National Committee, Box 55, Alexandria, N.S.W. 2015 or contact the local committee through the USE.

The Institution of Engineers, Australia

The Institution of Engineers, Australia is the professional body for engineering in this country. Its aim is to promote the science and practice of engineering. In doing this it protects engineering standards as well as running such activities as lectures, conferences and seminars. The Graduates and Students Section (GAS) of the Institution represents all student and graduate members, and organizes general activities such as film nights, site tours, a public speaking competition and a harbour cruise.

Student Membership, which is open to all engineering students, allows concessions to Institution functions as well as providing the various publications produced by the Institution. Membership application forms and more information may be obtained from Engineering School Offices, GAS representatives, or the Institution Headquarters.

Undergraduate Study

Undergraduate Courses

The Faculty of Engineering consists of seven Schools—Civil, Electrical, Mechanical and Industrial, Highway, Nuclear, Transportation and Traffic, and surveying. The Schools of Civil, Electrical, and Mechanical and Industrial offer full-time courses leading to the degree of Bachelor of Engineering, and part-time courses leading to the degree of Bachelor of Engineering or Bachelor of Science (Engineering). The School of Surveying offers a full-time, part-time and sandwich course leading to the degree of Bachelor of Surveying. The Schools of Highway Engineering, Nuclear Engineering and Transportation and Traffic Engineering offer graduate courses only.

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

Common First Year

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

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

General Rules for Progression

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

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

2. Students must satisfy the rules governing re-enrolment: in particular, these require all subjects of the first year to be completed by the end of two years of full-time (or four years of part-time) study.

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.

Full-time Courses

Full-time courses of four-years' duration are offered in Civil, Electrical, Mechanical, Industrial, and Aeronautical Engineering, and in Naval Architecture: all of these lead to the degree of Bachelor of Engineering. A four-year full-time course in Surveying is offered by the School of Surveying leading to the degree of Bachelor of Surveying.

The award of the degree of Bachelor of Engineering is recognized by the Institution of Engineers, Australia, as giving complete exemption from the examinations required for admission to the grade of Member. In nearly all cases substantial or complete recognition is accorded to these courses by overseas engineering institutions.

Industrial Training Requirements

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

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

Part-time Courses

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

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

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

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

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

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

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

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

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

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

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

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

A comply with the requirements for admission;

B follow the prescribed course of study in the appropriate school and pass the necessary examinations;

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

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

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

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

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

Conditions for the Award of the Degree of Bachelor of Engineering

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

A comply with the requirements for admission;

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

C 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 shall be required to complete the first year of the course in not more than two years. Re-enrolment thereafter will be governed by the general regulations of the Professorial Board.

4. 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 except for students in the School of Electrical Engineering, where such training is recommended but not required. In addition to the above requirements a student coming from another institution must follow an approved course of study in this University for at least two years.

5. The degree shall be awarded in the pass or honours grade. Honours may be awarded in the following categories:
Honours Class I
Honours Class II, Division I
Honours Class II, Division II

Conditions for Award of Degree of Bachelor of Surveying

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

A comply with the requirements for admission;

B follow the prescribed course of study in the School of Surveying and satisfy the examiners in the necessary subjects;

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

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

3. A student shall be required to complete the first year of the course in not more than two years. Re-enrolment thereafter will be governed by the general regulations of the Professorial Board.

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

5. 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

Faculty of Applied Science

The Faculty of Applied Science offers courses to students desiring a career in a specialized technology with an engineering element. These courses are as follows:

	Full-time	*Part-time*
Chemical Engineering	BE	BE
Ceramic Engineering	BSc	BSc(Tech)
Metallurgy	BSc	BSc(Tech)
Metallurgical Engineering	BE	—
Mining Engineering	BE	BSc(Eng)†
Textile Engineering	BSc	—

Entrance to these courses, which are of four years' duration full-time (pass or honours) and six years' duration part-time, is conditional upon completion of the full subject Chemistry I. Except in the case of Mining Engineering, transfer should be made at the end of the first year to achieve maximum standing. Full-time engineering students may enter the Mining Engineering course after the second year of courses in Mechanical, Electrical or Civil Engineering without loss in standing of subjects completed.

Part-time engineering students may enter the courses offered by the Schools of Chemical Engineering, Chemical Technology and Metallurgy after the second stage part-time or the full-time first year. They may enter the Mining Engineering course after the fourth stage. In all cases the requirements for the degree of BSc(Tech) demand three years approved concurrent industrial training.

In the case of Chemical Engineering the part-time course, spread over seven years, leads to the award of the degree of BE.

Holders of the degrees of BSc in Textile Technology (Textile Engineering course) of BE (pass or honours) in Chemical Engineering and BSc(Eng) in Mining Engineering are recognized by the Institution of Engineers of Australia as being eligible for Corporate Membership without further examination.

Ceramic Engineering

Ceramics are inorganic, non-metallic materials which usually require the use of high temperatures in their processing. Products of the industry include glass, refractories, bricks, tiles, pipes, abrasives, cement, plaster, nuclear ceramics, whitewares, enamels and electric insulators, dielectrics and magnetic materials. The ceramic engineer is concerned with the relationship between the atomic and crystal structure of materials and their chemical, physical and engineering properties, as well as the methods of their manufacture and fabrication into useful shapes.

Graduates in Ceramic Engineering take positions in the fields of research and development, production control, product evaluation and technical service.

Chemical Engineering

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

† A part-time course in Mining Engineering leading to the award of the BSc(Eng) degree is available at Broken Hill as well as a part-time course in Mineral Processing leading to the award of the BSc(Tech) degree.

Metallurgy and Metallurgical Engineering

Metallurgy deals with the nature, production, properties and uses of metals. Its importance today is associated with the demands for better materials for aircraft, rockets, and nuclear reactors, as well as the more conventional engineering structures, machines and appliances. Metallurgists are also closely involved with the development of new and more efficient processes for extracting metals from their ores and contributing to mineral production.

The BSc course in Metallurgy is a general one covering all aspects of the production, structure and properties of metallic materials. The BE course is more specialized in the final two years and provides preparation for careers in the metallurgical process industries.

The School of Metallurgy has excellent facilities for teaching and research. Emphasis in these courses is on the application of science to technological problems and in this respect there is a close relationship between metallurgy and engineering. Information on the Metallurgy courses and on opportunities for graduate work for engineering graduates in the School of Metallurgy may be obtained from the Faculty of Applied Science Handbook or from Professor Hugh Muir at the School of Metallurgy.

Mining Engineering

The aim of the training is to give students a thorough foundation in Mining Engineering and so permit them to enter quarrying, coal mining, metalliferous mining or the petroleum industry, and to be employed in any of the phases of these industries ranging from exploration to production.

During the undergraduate course, students will spend portion of the long vacations obtaining practical experience in mining. Mining companies prepare programs so that the students obtain a comprehensive experience in many aspects of the profession. This experience is important and it is related to the academic training received in the School. Practical experience in mining, gained as a student, can contribute to the experience record of mining engineers when making application for a statutory certificate of competency from one of the Australian State Government Departments of Mines.

At Broken Hill the School of Mining Engineering offers a part-time course in Mineral Processing, leading to the degree of Bachelor of Science (Technology) and a part-time course in Mining Engineering, leading to the degree of Bachelor of Science (Engineering).

Textile Engineering

The textile industry, being a manufacturing one, depends on many types of machinery and engineering services to produce its products. In order to cope with technological problems in production, quality control and research, a competent textile engineer must have a good understanding of the fundamental sciences and extensive theoretical and practical knowledge of the applied textile and engineering sciences.

There are many challenging positions for textile engineers in industry and research.

Full details of the above courses may be obtained from the Faculty of Applied Science Handbook.

Undergraduate Study

Course Outlines

School of Civil Engineering

The School of Civil Engineering offers two degree courses in Civil Engineering: the Bachelor of Engineering (BE) course which can be taken on a 4-year full-time basis, a 7-stage part-time basis or any approved combination of full-time and part-time study; and the Bachelor of Science (Engineering (BSc(Eng)) course, which is a part-time program, comprising the first six stages of the 7-stage Bachelor of Engineering course. The requirements for the BE degree include a period of at least sixty working days of approved industrial experience prior to enrolment in the final year; the requirements for the BSc(Eng) degree include a period of at least three years of suitable engineering experience (8.002 Industrial Experience) concurrent with the University course. Students should enroll in the subject 8.002 Industrial Experience in the year in which they expect to satisfy the requirements, and upon completion, submit to the school evidence from their employers of such industrial training. No enrolments are now accepted for the BSc(Eng) course in Civil Engineering; the last initial enrolment year was 1974.

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

The degree of Bachelor of Engineering may be conferred as a Pass degree or as an Honours degree. There are two classes of Honours, Class 1, and Class 2 in two divisions, and the award and grade of Honours are made in recognition of superior performance throughout the course. The degree of Bachelor of Science (Engineering) may be awarded with Merit in recognition of superior performance throughout the course.

362
Civil Engineering—Full-time Course
Bachelor of Engineering
BE

		Hours per week S1	S2
Year 1			
1.001 / 1.011	Physics I *or* Higher Physics I	6	6
2.021	Chemistry IE	6	0
5.010	Engineering A	6	0
5.020	Engineering B	6	0
5.030	Engineering C	0	6
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	6	6
		24	24
Year 2			
8.172	Mechanics of Solids II	4	0
8.181	Structural Design I	2½	2½
8.272	Civil Engineering Materials I	4	4
8.301	Systems Engineering	4	0
8.571	Hydraulics I	0	3
8.671	Engineering Construction	3	0
10.022	Engineering Mathematics II	4	4
29.441	Engineering Surveying	0	6
29.491	Survey Camp†	—	—
	Two Electives*	3	3
		24½	22½

* See this footnote on next page, below Stage 4.

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

		Hpw S1	Hpw S2
Year 3			
8.173	Structural Analysis I	3	0
8.174	Structural Analysis II	0	3
8.182	Structural Design II	3	3
8.273	Civil Engineering Materials II	3	3
8.351	Engineering Mathematics	5	0
8.572	Hydraulics II	3	0
8.573	Hydraulics III	0	3
8.581	Water Resources I	3	0
8.582	Water Resources II	0	3
8.672	Planning and Management I	0	4
	Two Electives*	3	3
		23	22

*See this footnote below Stage 4.

Year 4			
8.001	Industrial Training	—	—
8.191	Structural Engineering	3	0
8.274	Civil Engineering Materials III	3	3
8.583	Water Resources III	3	0
8.673	Planning and Management II	3	0
8.674	Planning and Management III	0	3
8.051	Design Projects I	0	2½
8.052	Design Projects II	0	2½
	Six Electives*	9	9
		21	20

*See this footnote below Stage 4.

362
Civil Engineering: Part-time Course
Bachelor of Engineering
BE

		Hours per week S1	Hours per week S2
Stage 1			
1.001	Physics I *or*	6	6
1.011	Higher Physics I		
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I**		
		12	12

**Not available in the evening in 1976.

Stage 2			
2.021	Chemistry IE	6	0
5.010	Engineering A	6	0
5.020	Engineering B	0	6
5.030	Engineering C	0	6
	One Elective*	1½	1½
		13½	13½

*See this footnote below Stage 4.

		Hpw S1	Hpw S2
Stage 3			
8.172	Mechanics of Solids II	0	4
8.272	Civil Engineering Materials I	4	4
10.022	Engineering Mathematics II	4	4
29.441	Engineering Surveying**	6	0
29.491	Survey Camp†	—	—
		14	12

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

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

Stage 4			
8.181	Structural Design I	2½	2½
8.273	Civil Engineering II	3	3
8.301	Systems Engineering	0	4
8.571	Hydraulics I	3	0
8.671	Engineering Construction	0	3
	One Elective*	3	0
		11½	12½

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

Approved technical electives for Year 2 are: 8.040 Advanced Engineering Geology, 8.044 Electrical Instrumentation, 8.045 Electrical Machinery, 8.047 History of Civil Engineering.

Approved technical electives for Year 3 include those listed for Year 2 and 8.018 Construction Engineering, 8.021 Environmental Aspects of Civil Engineering, 8.023 Hydrodynamics, 8.026 Systems Methods in Civil Engineering, 8.027 New Materials I.

Approved technical electives for Year 4 include those listed for Year 2 and Year 3 and 8.011 Projects, 8.012 Elements of Architecture, 8.013 Bridge Engineering, 8.014 Computer Applications in Civil Engineering, 8.015 Road Engineering, 8.016 Hydraulics, 8.017 Transportation Engineering, 8.019 Railway Engineering, 8.020 Hydrology, 8.022 Elasticity and Plasticity, 8.024 Foundation and Dam Engineering, 8.025 Structural Failures, 8.032 Law for Builders, 8.033 Industrial Law and Arbitration, 8.037 Optimum Design of Structures, 8.038 Special Topics in Reinforced Concrete, 8.043 Public Health Engineering.

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

Stage 6			
8.001	Industrial Training	—	—
8.154	Structures	4	4
8.252	Civil Engineering Materials	4	0
8.254	Civil Engineering Materials	0	6
8.632	Civil Engineering	1½	1½
	General Studies Elective	1½	1½
		11	13

		Hpw S1	S2
Stage 6*			
8.174	Structural Analysis II	3	0
8.191	Structural Engineering	0	3
8.274	Civil Engineering Materials III	3	3
8.573	Hydraulics III	3	0
8.581	Water Resources I	0	3
8.582	Water Resources II	3	0
	Two Electives	1½	4½
		13½	13½

*Available in 1977 for the first time.

Stage 7*			
8.001	Industrial Training	—	—
8.051	Design Projects I	2½	0
8.052	Design Projects II	2½	0
8.583	Water Resources III	0	3
8.673	Planning & Management II	3	0
8.674	Planning & Management III	0	3
	Four Electives	6	6
		14	12

*Available in 1978 for the first time.

School of Electrical Engineering

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

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

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

The School of Electrical Engineering offers a full-time course of four years duration leading to the degree of Bachelor of Engineering (pass or honours), and a six year part-time course for the degree of Bachelor of Science (Engineering). 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. Thus 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.

The degrees of Bachelor of Engineering and Bachelor of Science (Engineering) are recognized by the Institution of Engineers, Australia, the Institution of Radio and Electronics Engineers, Australia, and the Institution of Electrical Engineers, London, as giving complete exemption from the examinations required for admission, to Graduate or Corporate membership. The Institution of Engineers, Australia, is reviewing its requirements for graduates completing their course after June 1980.

Honours

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

Industrial Experience

All students in the BSc(Eng) course must complete three years of concurrent appropriate industrial training. Students should enrol in the subject 6.902 Industrial Experience in the year in which they expect to satisfy their requirements and, upon completion, submit to the School evidence from their employers to such industrial training.

All students in the BE course are expected to seek practical experience in the long vacations. This is strongly recommended and students are warned that they may not be eligible for graduate membership of the Institution of Engineers (Australia) until they have completed at least 12 weeks of such training, preferably concurrently with their course.

364
Electrical Engineering—Full-time Course
Bachelor of Engineering
BE

		Hours per week S1	S2
Year 1 (Revised for 1976)			
1.001	Physics I*	6	6
5.030	Engineering C	6	0
6.010	Electrical Engineering I	0	6
10.001	Mathematics I*	6	6
	Either		
2.001	Chemistry I	6	6
	or		
2.021	Chemistry IE and	6	0
5.010	Engineering A	0	6
		24	24

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

Year 2 (Revised for 1976)

		Hours per week S1	S2
1.112A	Electromagnetism*	0	6
1.112C	Waves in Continuous Media and Thermodynamics*	2	2
6.021A	Basic Circuit Theory	4	0
6.021B	Power	0	4
6.021C	Electronics	0	4
6.021E	Digital Logic	4	0
6.022	EE Materials	0	4
10.111A	Pure Mathematics II (Linera Algebra)*	2	2
10.111B	Pure Mathematics II (Analysis)*	2	2
10.211A	Applied Mathematics II (Mathematical Methods)*	2	2
	One General Studies Subject	3	0
	Either		
1.112B	Modern Physics*	6	0
	or		
6.601A†	Introduction to Computing	5	0
		24	26
		or	
		25	

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

†In 1977, 6.601A is replaced by a 4 hour subject 6.021D which builds on the new computing strand in 5.030.

Year 3 (Old Course)

5.661	Mechanical Engineering III	3	3
10.033	Electrical Engineering Maths III	2	2
10.361	Statistics SE	1½	1½
	Electrical Engineering III		
6.031A	Systems and Circuit Theory	4	4
6.031B	Energy Conversion, Transmission and Utilization	4	4
6.031C	Electronic Circuits and Signal Processing	4	4
6.031D†	Computing	0	4
6.031E	Electron Physics and Devices	4	0
	Two General Studies Subjects	3	3
		25½	25½

†In 1977, 6.031D will be dropped for students having done 6.021E, and replaced by a new subject tentatively titled Basic Engineering Science: this will be part of a wider ranging revision of Year 3.

Year 4 (Old Course)

6.911 *or*
6.931 Individual (or Group) Thesis*
One General Studies Subject
Electrical Engineering IV (6 Electives)†

**Thesis*
In Session 1 two hours per week and in Session 2 three days per week are devoted to directed laboratory and research work on an approved subject under the guidance of members of the lecturing staff. Generally, the project involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar and a written thesis must be submitted on each project by the last Monday in November.

†*Electrical Engineering IV*
Four Electives are taken in Session 1 and two in Session 2. Each Department offers specialized electives and a number of general electives are also available. Not all electives are offered every session: students are advised each year which electives are available. Each electives is 5 hours per week for one session. The list of electives is:

6.041 Fields and Measurements
6.042 Circuits, Signals and Information Theory
6.044 Electrical Product Design and Reliability
6.202 Power Engineering Systems I
6.203 Power Engineering Systems II
6.212 Power Engineering Utilization
6.222 High Voltage and High Current Technology
6.303 Communication Electronics,
6.313 Wave Radiation and Guidance
6.322 Electronics
6.323 Signal Transmission
6.333 Communication Systems
6.383 Biomedical Engineering
6.412 Automatic Control
6.413 Modern Control Engineering
6.432 Computer Control and Instrumentation
6.512 Advanced Semiconductor Device Theory
6.522 Transistor and Integrated Circuit Design
6.612 Computer Systems Engineering
6.622 Computer Application and Systems

The program selected by each student must be approved by the Head of School.

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Electrical Engineering—Part-time Course
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 (Revised for 1976)

6.010	Electrical Engineering I	6	0
5.030	Engineering C	0	6
	Either		
2.001	Chemistry I	6	6
	or		
2.021	Chemistry IE *and*	0	6
5.010	Engineering A	6	0
		12	12

		Hpw S1		Hpw S2
Stage 3 (Revised for 1976)				
6.021A	Basic Circuit Theory	4		0
6.021B	Power	4		0
6.021C	Electronics	0		4
1.112C	Waves in Continuous Media and Thermodynamics	0		6
10.111A	Pure Mathematics II (Linear Algebra)	2		2
10.111B	Pure Mathematics II (Analysis)	2		2
		12		14
Stage 4 (Old Course)				
1.112A	Electromagnetism	0		6
1.112B	Modern Physics	6		0
6.031A	Systems & Circuit Theory	4		4
10.211A	Applied Mathematics II (Mathematical Methods)	2		2
	One General Studies Subject	1½		1½
		13½		13½
Stage 5 (Old Course)				
4.921	Material Science	1		1
6.031B	Energy Conversion Transmission & Utilization	4		4
6.031C	Electronic Circuits and Signal Processing	4		4
	Two General Studies Subjects	3		3
		12		12
Stage 6 (Old Course)†				
6.031D	Computing	2		2
6.043	Measurements	2		2
	Two Professional Electives*	5		5
	Either			
6.031E	Electron Physics and Devices	2		2
	or			
5.661	Mechanical Engineering	3		3
		11	*or*	12

Transition Arrangements into Revised Programs

There are no transistion problems for students who progress normally. Students with broken programs may consult the School office for their detailed status: no student will lose credits for any subjects completed. Note that 6.021 is replaced by 6.021A, 6.021B *and* 6.021C; 6.031D becomes 6.021E; 8.113/4.921 will be replaced by 6.022 *and* a new subject on Basic Engineering Science in 1977.

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

†Students who have not completed 6.902 Industrial Experience by this stage of their course should include the subject in their program. For further details of the requirement see the introduction to School of Electrical Engineering.

Electrical Engineering—Substitution of Subjects

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

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

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

Examples are:

A Replacement of two General Studies subjects by an approved Arts subject;

B Replacement of two General Studies subjects by an approved (by the Head of the Department of General Studies) subject from areas such as:

Life Sciences;
Earth Sciences;
Accounting and Business Administration;
Law;
Economics;
Industrial Management.

C If students proposing to attempt the BSc BE pattern include additional Computer Science or Applied Mathematics in their Second Year Electrical Engineering program they open up a wider choice of subjects in their Science Third Year. This can be substituted for 8.113, or 4.921 General Studies. Subjects omitted may be required to be taken in the student's Third Year of Electrical Engineering;

D The normal Fourth Year of the BE program includes 6 units of Electrical Engineering IV. Students may substitute for ONE of these units, a subject of suitable level and difficulty from an area outside the School of Electrical Engineering.

Double Degrees

Double Degree of BSc BE in Electrical Engineering

Students in Electrical Engineering may qualify for this double degree in five years of full-time study. Having completed the first and second year of the Electrical Engineering course, students with a creditable performance may transfer to Science (this is subject to the recommendation of the Head of the School of Electrical Engineering and the approval of the Deans of the Faculties of Engineering and Science) and do the appropriate General Studies subjects and four Level III units chosen from related disciplines and no less than four other units of either Level II or Level III chosen in accordance with the Science Course regulations.

In their fourth year the students revert to the Faculty of Engineering. Depending on the program followed in thier 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. In their fifth year they will complete the fourth year of the Electrical Engineering course.

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Double Degree BA BE in Electrical Engineering

The double degree BA BE in Electrical Engineering may be gained by a five-year course of combined study. Students wishing to enrol for this double degree may do so:

1. by initially enrolling as a student proceeding to the double degree, or

2. by transferring to the BA BE program with advanced standing after partially completing the requirements of 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 of both the Faculties concerned. Students wishing to enrol in or to transfer into the double degree course may do so only after receiving the approval of the respective Deans of the Faculties of Arts and Engineering. Guidance should be sought from the School of Electrical Engineering, the relevant schools in the Faculty of Arts and the Arts Faculty Office.

1. 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:

A the subjects in Table A below, and

B 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.

In addition he shall also study concurrently subjects selected from Course 364 in accordance with an acceptable program loading.

To complete his studies he must satisfy the requirements of a normal BE program in Electrical Engineering, less
1. the General Studies subjects,

2. the equivalent of ONE non-electrical engineering subject of the BE course,

3. strand E of Electrical Engineering III, and

4. one of the six units of Electrical Engineering IV.

Table A*

10.001	Mathematics I
10.111A	Pure Mathematics II (Linear Algebra)
10.111B	Pure Mathematics II (Analysis)
10.211A	Applied Mathematics II (Mathematical Methods)
1.001	Physics I
1.112A	Electromagnetism
1.112B	Modern Physics
1.112C	Thermodynamics & Mechanics

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

2. 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.

3. Honours Degree in Arts

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

School of Mechanical and Industrial Engineering

The courses in the School are planned to provide the appropriate academic training for the professional engineer in the fields of aeronautical, industrial and mechanical engineering, and for the naval architect.

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

The full-time courses of Mechanical, Industrial and Aeronautical Engineering and of Naval Architecture have common subjects for the first two years. The third and fourth years contain a number of common core subjects together with specific departmental requirements. In the fourth and final year, in addition to core subjects and departmental requirements, provision is made for a limited degree of specialization in one or more elective subjects. Each full-time student is required to present a thesis at the end of his final year and to deliver a short paper on the subject of his thesis. General studies form a regular part of all courses. In certain instances and with permission from the Head of the School students may substitute an Arts subject in lieu of two General Studies subjects.

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

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

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

All students will be considered for the award of Honours which will be granted for meritorious performance in the course with particular emphasis on the later years. With the approval of the Head of School, students may proceed to the BE degree via a combination of full-time and part-time study.

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

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

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

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

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

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

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

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Mechanical Engineering—Full-time Course
Bachelor of Engineering
BE

		Hours per week S1	S2
Year 1			
1.001	Physics I *or*	6	6
1.011	Higher Physics I		
2.021	Chemistry IE*	6	6
5.010	Engineering A*	6	6
5.020	Engineering B	0	6
5.030	Engineering C*	6	6
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I		
Year 2			
5.032	Experimental Engineering II	2	2
5.061	Technical Orientation	½	½
5.111	Mechanical Engineering Design I	4	4
5.311	Engineering Mechanics	0	2½
5.611	Fluid Mechanics/Thermodynamics I	4	4
6.801	Electrical Engineering	3	3
8.172	Mechanics of Solids	4	0
8.259	Properties of Materials	3	3
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½
		26	24½
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 I	2	2
5.612	Fluid Mechanics/Thermodynamics II	3½	3½
6.802	Electrical Engineering*	3	3
18.011	Industrial Engineering IA *or*	2	2
18.021	Industrial Engineering IB	2	2
	General Studies Elective	3	3

		Hours per week
Year 4		
5.044	Industrial Training II	0
5.051	Thesis	6
5.062	Communications	2
5.324	Automatic Control Engineering	3
	General Studies Elective	1½

Plus 12 hours per week from the following technical electives:

4.913	Materials Science	3
5.113	Mechanical Engineering Design III	6
5.332	Dynamics of Machines II	3
5.413	Mechanics of Solids II	3
5.614	Fluid Mechanics III	3
5.615	Thermodynamics III	3
8.026	Systems Methods in Civil Engineering	3
18.012	Industrial Engineering IIA	3
18.022	Industrial Engineering IIB	3
18.431	Design for Production	3
18.551	Operations Research	3
23.051	Nuclear Power Technology	3

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

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Mechanical Engineering—Part-time Course
Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 1

		Hours per week
1.001	Physics I *or*	6
1.011	Higher Physics I	
10.001	Mathematics I *or*	6
10.011	Higher Mathematics I*	
		12

*Not available in the evening in 1976.

Stage 2

		Hours per week S1	S2
2.021	Chemistry IE*	6	6
5.010	Engineering A*	6	6
5.020	Engineering B†	0	6
5.030	Engineering C*	6	6

*One session only. Students will take this subject in either Session 1 or Session 2.
†Broken Hill students take 5.031 Engineering Mechanics (1—) in lieu of 5.020.

Stage 3

5.311	Engineering Mechanics	0	2½
8.172	Mechanics of Solids	4	0
8.259	Properties of Materials	3	3
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½
		12½	11

Stage 4

		Hpw
5.032	Experimental Engineering II	2
5.111	Mechanical Engineering Design I	4
5.611	Fluid Mechanics/Thermodynamics I	4
6.801	Electrical Engineering	3
	General Studies Elective	1½
		14½

Stage 5

5.071	Engineering Analysis	3½
5.112	Mechanical Engineering Design II	3
5.331	Dynamics of Machines I	2
5.412	Mechanics of Solids I	2
5.612	Fluid Mechanics/Thermodynamics II	3½
		14

Stage 6

5.042	Industrial Experience*	0
5.113	Mechanical Engineering Design III	6
5.324	Automatic Control Engineering	3
	General Studies Elective	1½
Plus one of the following technical electives:		
4.913	Materials Science	
5.332	Dynamics of Machines II	3
5.413	Mechanics of Solids II	
		13½

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

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

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

Year 3

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

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

Year 4

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

360
Aeronautical Engineering—Part-time Course
Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 5

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

Stage 6		Hours per week
5.042	Industrial Experience*	0
5.801	Aircraft Design	4
5.812	Aerodynamics II	3
5.823	Analysis of Aerospace Structures II	2
5.831	Aircraft Propulsion	2
	General Studies Elective	1½
		12½

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

The first and second years of this course are identical with the first two years of the full-time course in Mechanical Engineering. Subject to the Head of the School of Mechanical and Industrial Engineering being satisfied that the present extent of equivalences is maintained, and on his recommendation, Faculty has approved an arrangement by which students who satisfy the requirements of the first two years of the Mechanical Engineering degree course at any other Australian university 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 I	2	2
5.911	Naval Architecture	4	4
5.921	Ship Structures I	2	2
5.931	Principles of Ship Design IA	1½	0
5.932	Principles of Ship Design IB	0	1½
5.951	Hydrodynamics	1½	0
18.021	Industrial Engineering IB	2	2
	General Studies Elective	3	3
		22½	19½

Year 4		Hpw
5.044	Industrial Training II	0
5.051	Thesis	6
5.062	Communications	2
5.922	Ship Structures II	2
5.933	Principles of Ship Design II	3
5.934	Ship Design Project	3
5.941	Ship Propulsion and Systems	4
	General Studies Elective	1½
Plus one of the following technical electives:		
4.913	Materials Science	
8.026	Systems Methods in Civil Engineering	
18.022	Industrial Engineering IIB	3
18.551	Operations Research	
		24½

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

371
Naval Architecture—Part-time Course
Bachelor of Science (Engineering)
BSc(Eng)

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

Stage 5		Hours per week S1	S2
5.071	Engineering Analysis	3½	3½
5.303	Mechanical Vibrations	1½	0
5.412	Mechanics of Solids I	2	2
5.911	Naval Architecture	4	4
5.921	Ship Structures I	2	2
5.932	Principles of Ship Design IB	0	1½
		13	13

Stage 6		Hpw
5.042	Industrial Experience*	0
5.922	Ship Structures II	2
5.933	Principles of Ship Design II	3
5.934	Ship Design Project	3
5.941	Ship Propulsion and Systems	4
	General Studies Elective	1½
		13½

Department of Industrial Engineering

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

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

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

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

of equipment in relation to buildings to permit efficient handling of materials; the avoidance or elimination of bottlenecks; the related problems of quality and cost control, testing and inspection; labour and personnel relations; and, finally, the problem of distribution and sales.

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

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

The Work of the Industrial Engineer

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

1. Industrial Economic Analysis

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

2. Planning and Control of Production

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

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

3. Product and Process Design

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

Further, the product has to be adapted to suit existing manufacturing equipment, or a manufacturing process has to be developed by means of which an existing product can be manufactured at the right price and of the right quality. The design work of the industrial engineer incorporates also problems of equipment selection and application for both economy and performance.

Fundamental scientific studies of manufacturing processes such as metal machining, forming and casting are continually being made to improve their efficiency.

4. Methods Engineering

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

5. Operations Research

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

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

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Industrial Engineering—Full-time Course
Bachelor of Engineering
BE

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

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

*One session only.

†Half-session only.

Year 4

5.044	Industrial Training II	0
5.051	Thesis	6
5.062	Communications	2
18.012	Industrial Engineering IIA	3
18.022	Industrial Engineering IIB	3
18.431	Design for Production	3
18.551	Operations Research	3
	General Studies Elective	1½

Plus one elective chosen from:

4.913	Materials Science	
5.324	Automatic Control Engineering	
5.332	Dynamics of Machines II	3
5.413	Mechanics of Solids II	
8.026	Systems Methods in Civil Engineering	
		24½

367
Industrial Engineering—Part-time Course
Bachelor of Science (Engineering)
BSc(Eng)

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

For outline of the first four stages see the Mechanical Engineering part-time course.

Stage 5

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

*One session only.
†Half-session only.

Stage 6

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

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

School of Surveying

The School of Surveying offers a full-time course and a sandwich course leading to the Degree of Bachelor of Surveying. The full-time course is of four years' duration and is divided into eight parts of one session each. The sandwich course also consists of eight parts of one session each and may be completed in six or seven years. Until 1975, a part-time course of seven years duration was available for those who wished to attend classes in the evenings. This course is now being phased out and is being replaced by the sandwich course.

The course is designed to provide the appropriate academic training for a professional surveyor working in any of the many branches of surveying. Since these branches cover a wide range, the course is broad in its scope. Parts 1-4 of the course are concerned mainly with the basic sciences, but the basic surveying subjects are also included. In Parts 5 and 6, the major surveying subjects appear: geodesy, photogrammetry, astronomy and land studies. With the addition of some elective courses these are continued into Part 8. Part 7 comprises professional training and a survey camp. The graduate can take up cadastral or property surveying, engineering surveying, geodetic surveying, photogrammetry, cartography or hydrographic surveying. The course is also an appropriate first qualification for those wishing to specialize in astronomy, satellite geodesy, geodynamics, computing and systems analysis, town and regional planning, land and resources development or environmental sciences.

The course has undergone comprehensive revision in recent years. Features of the revisions include: decreased lecture time to allow use of teaching methods which involve more student participation; an extended period of professional experience in the final year; Land Studies, a group of subjects designed to provide a broad understanding of the ecology of land and its development; and a survey camp of four weeks in the final year. Throughout the course the theoretical studies are complemented by practical exercises in the field and the laboratory. Students make use of the most modern measuring instruments and computing equipment. As far as possible each stage of the part-time course is equivalent to one part (one session) of the full-time course. However Stage 7 includes the Survey Camp of Part 7 as well as subjects of Part 8.

Students attending the sandwich course will attend full-time for one session per year, and will be free to undertake full-time employment for the remainder of the year, approximately 35 weeks. The standard time for completion of the sandwich course will be seven years. It will also be possible for a student in the sandwich course to attend for both sessions in a year, thus decreasing the length of his course by one year.

During the period that the part-time course is being phased out the transistion arrangements are as follows: part-time students who commenced before 1973 will be unaffected. Those who commenced in 1973 and 1974 will move into the sandwich system in 1975 and 1976 respectively and each year from then on will attend full-time for one session of each year. Students commencing the sandwich course in

1976 *either* attend full time for one year in 1976 and switch to Part 3 of the sandwich course in 1977 *or* take part-time classes in 1976 and 1977 (part-time Stages 1 and 2) and switch to Part 3 of the sandwich course in 1978. Thereafter they will follow the pattern of the sandwich course. See diagram below: *Method of Implementation of the Sandwich Course.*

Part 1 and Parts 5-8 of the sandwich course are not offered in 1976.

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

Students wishing to become Registered Surveyors after graduation are advised to gain practical experience under a Registered Surveyor. Some reduction in the period of practical experience required before registration may be granted because of practical experience gained during the University course, provided the New South Wales Surveyors' Board has been 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.

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Surveying—Full-time Course
Bachelor of Surveying
BSurv

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

		Hours per week
1.001	Physics I	6
5.030	Engineering C*	5
10.001	Mathematics I	6
29.001	Surveying IA	5½
		22½

*Introduction to Systems and Computers Option.

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

1.001	Physics I	6
5.010	Engineering A*	6
10.001	Mathematics I	6
29.002	Surveying IB	6½
		24½

*4.901 Materials Option.

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

		Hours per week
10.022	Engineering Mathematics II	4
10.341	Statistics SU	1½
29.102	Surveying II	6
29.151	Survey Computations I	6
31.212	Geometrical Optics	3
		20½

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

6.822	Electronics	3
8.711	Engineering for Surveyors	3
10.022	Engineering Mathematics II	4
10.341	Statistics SU	1½
29.102	Surveying II	3
29.192	Survey Camp*	—
27.295	Physical Geography for Surveyors†	4
29.161	Hydrographic Surveying I	
	or	2
29.182	Cartography Elective	
	General Studies Elective	3
		23½

*Students are required to attend a two-week survey camp, which is equivalent to 80 class contact hours.

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

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

8.712	Engineering for Surveryors	3
29.311	Astronomy I	3
29.511	Photogrammetry I	6
29.612	Land Studies II†	5
36.411	Town Planning	2
	General Studies Elective	3
		22

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

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

29.103	Surveying III	7
29.152	Survey Computations II	3
29.211	Geodesy I	6
29.613	Land Studies III	2
29.614	Land Studies Project	3
	General Studies Elective	3
		24

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

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

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

Year 4 — Hours per week

Session 2 **(Part 8)**

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

†Electives chosen from:

29.162	Hydrographic Surveying*
29.183	Cartography Advanced Elective*
29.213	Geodesy III
29.313	Astronomy III
29.513	Photogrammetry III
29.615	Land Studies
29.173	Project

*Not offered in 1976.

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Surveying—Sandwich Course
Bachelor of Surveying
BSurv

Students commencing the Sandwich Course in 1976 *either* attend full time for one year in 1976 and switch to Part 3 of the sandwich course in 1977 *or* take part-time classes in 1976 and 1977 (part-time Stages 1 and 2) and switch to Part 3 of the sandwich course in 1978. See diagram below.

1. Full-time

See Year 1, full-time course.

2. Part-time

Stage 1 — Hours per week

1.001	Physics I	6
10.001	Mathematics I	6
		12

Stage 2

		Hours per week S1	S2
5.010	Engineering A*	6	0
5.030	Engineering C**	0	5
29.001	Surveying IA	5½	0
29.002	Surveying IB	0	6½
		11½	11½

*4.901 Materials Option.

**Introduction to Systems and Computers Option.

3. Sandwich Course

Part 2

Offered in Session 2 — Hours per week

1.201	Physics I (Part 2)	6
5.010	Engineering A†	6
10.001/2	Mathematics I (Part 2)	6
29.002	Surveying IB	6½
		24½

†4.901 Materials Option.

Part 3

Offered in Sessions 1 and 2

10.022	Mathematics II	4
10.342A	Statistics SU	1½
29.102	Surveying II	9
29.151	Survey Computations I	6
31.212	Geometrical Optics	3
		23½

Part 4

Offered in Session 1

6.822	Electronics	3
10.342A	Statistics SU*	1½
8.711	Engineering for Surveyors	3
10.022	Engineering Mathematics II	4
29.192	Survey Camp**	—
27.295	Physical Geography for Surveyors†	4
29.161	Hydrographic Surveying or	2
29.182	Cartography Elective	
	General Studies	3
		20½

*Students who passed in 10.341 Statistics in 1975 do not take this subject.

**Students are required to attend a two-week survey camp, equivalent to 80 class contact hours during Session 2 along with the full-time students.

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

Parts 5 to 8

Not offered in 1976.

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Surveying—Part-time Course
Bachelor of Surveying
BSurv

Stages 3 and 4

No longer offered.

Stage 5

		Hours per week S1	S2
8.712	Engineering for Surveyors	1½	1½
29.211	Geodesy I	3	3
29.311	Astronomy I	3	0
29.612	Land Studies II†	0	5
36.411	Town Planning	2	0
	General Studies Elective	1½	1½
		11	11

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

Stage 6

		Hpw for 2 sessions
29.103	Surveying III	3½
29.152	Survey Computation II	1½
29.511	Photogrammetry I	3
29.613	Land Studies III	1
29.614	Land Studies Project	1½
	General Studies Elective	1½
	General Studies Advanced Elective	1½
		13½

Stage 7*		Hours per week
29.212	Geodesy II	1½
29.312	Astronomy II	1½
29.512	Photogrammetry II	1½
8.713	Management for Surveyors	1
	Two Electives§	3
29.194	Survey Camp†	
		8½

*Students normally must fulfil the academic requirements of the subject, 29.193 Professional Training, before attempting Stage 7.

§Electives chosen from

29.162 Hydrographic Surveying II
29.183 Cartography Advanced Elective } Not offered in 1976.
29.213 Geodesy III
29.313 Astronomy III
29.513 Photogrammetry III
29.615 Land Studies
29.173 Project

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

Bachelor of Surveying

Method of Implementation of the Sandwich Course

Calendar Year	1975		1976		1977		1978		1979		1980		1981		1982	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Class Commencing in																
1973	Part 3		Part 4		Part 5	Part 6	Part 7	Part 8								
								Part 6	Part 7	Part 8						
1974	Stage 2		Part 3		Part 4		Part 5									
				Part 3		Part 4				Part 6	Part 7	Part 8				
1975 1.	Year 1															
2.	Part 1			Part 2		Part 3		Part 4		Part 5						
3.	Stage 1		Stage 2		Part 3		Part 4		Part 5			Part 6	Part 7	Part 8		
1976 1.			Year 1													
2.			Stage 1		Stage 2		Part 3		Part 4		Part 5			Part 6	Part 7	Part 8
								Part 3		Part 4		Part 5				

Note: The horizontal lines in the Table indicate the normal progression from Part to Part. A student may however change from one line to another in order to take the next part in the course, if he wishes to reduce the period of time required to complete the course.

Definitions: 'Year' means a 'year' in the full-time course
'Stage' means a 'stage' in the part-time course
'Part' means a 'part' in the sandwich course.

Graduate Enrolment Procedures

Graduate Study

Higher Degree Research Programs

New Students

Students seeking admission to Higher Degree (Research) must make application on the appropriate form which should be submitted to the Registrar. *Successful applicants will be advised by letter concerning the method of enrolment.*

Re-enrolling Students

Candidates registered for Higher Degrees (Research) are required to re-enrol at the commencement of each academic year. **Unless advised to the contrary* candidates should obtain re-enrolment forms and advice on procedure and fees from the office of the appropriate School** after 1 January 1976. Each candidate must complete a re-enrolment form and submit it to the Cashier. (See Enrolment Procedures earlier in this handbook.)

A candidate who has completed all the work for a graduate degree except for the submission of a thesis is required to re-enrol as above *unless* the thesis is submitted by 13 March 1976 in which case the candidate is not required to re-enrol.

*PhD and ME candidates re-enrolling in the School of Electrical Engineering should attend on Friday 20 February, 2.00 pm to 5.00 pm in Room G3 at the School.

PhD and ME candidates re-enrolling in the School of Mechanical and Industrial Engineering should attend on Friday 27 February, 2.00 pm to 5.00 pm in Room 106 at the School.

Masters and Graduate Diploma Courses

Note: All formal masters and graduate diploma students must lodge an authorised enrolment form with the Cashier on the day the enrolling officer signs the form. (For further details see the Enrolment Procedures and Fees section.)

New Students

Students seeking admission to formal masters courses and graduate diploma courses are required to apply on the appropriate form and by the closing date specified for the particular course (see the relevant Faculty Handbook). Unless advised to the contrary successful applicants are required to attend for enrolment at the appropriate time and place as listed below. The letter offering a place must be taken to the enrolment centre.

Re-enrolling Students

Candidates continuing formal graduate courses including those who have completed their formal examination but have not submitted their project report are required to attend for re-enrolment at the appropriate time and place as listed below:

Master of Engineering Science, Master of Surveying Science and Graduate Diploma Courses

Students are required to attend for enrolment on Friday 20 February at the locations and times specified below:

Civil Engineering (MEngSc)	Room 109 School of Civil Engineering 2.00 pm to 5.00 pm 6.00 pm to 8.00 pm

Electrical Engineering (MEngSc)	Room G3 School of Electrical Engineering 2.00 pm to 5.00 pm 6.00 pm to 8.00 pm
Highway Engineering (MEngSc) (GradDip)	School of Highway Engineering King Street, Randwick 2.00 pm to 6.00 pm *only*
Human Communication (GradDip)	Division of Graduate Extension Studies Room 1607 The Science Building 2.00 pm to 6.00 pm
Industrial Engineering (MEngSc) (GradDip)	Room 306 School of Mechanical and Industrial Engineering 2.00 pm to 5.00 pm 6.00 pm to 8.00 pm *only*
Mechanical Engineering (MEngSc)	Room 201 School of Mechanical and Industrial Engineering 6.00 pm to 8.00 pm *only*
Nuclear Engineering (MEngSc)	Room 325 School of Electrical Engineering 2.00 pm to 5.00 pm 6.00 to 8.00 pm
Surveying (MSurvSc)	School Office School of Surveying 2.00 pm to 5.00 pm *only*

Students are required to attend for enrolment on Friday 27 February as specified below:

Transportation and Traffic (MEngSc) (GradDip)	School of Transportation and Traffic King Street, Randwick 2.00 pm to 6.00 pm *only*

Qualifying Programs
(for admission to Higher Degree Candidature)

Students may only enrol in such programs after approval has been obtained from the relevant Higher Degree Committee.

Unless advised to the contrary successful applicants are required to attend for enrolment at the appropriate time and place as listed below. The letter offering a place must be taken to the enrolment centre.

Candidates who are continuing a qualifying program are required to attend for re-enrolment at the appropriate time and place as listed below.

Note: All qualifying students must lodge an authorised enrolment form with the Cashier on the day the enrolling officer signs the form. (See the Enrolment Procedures earlier in this handbook.)

Schools in the Faculty of Engineering	Friday 20 February 6.00 pm to 8.00 pm only
Mechanical Engineering	Room 201 School of Mechanical and Industrial Engineering
Civil Engineering	Friday 20 February 2.00 pm to 5.00 pm 6.00 pm to 8.00 pm Room 109 School of Civil Engineering
Surveying	Friday 20 February 2.00 pm to 5.00 pm only School of Surveying Office
Transportation and Traffic	Friday 27 February 2.00 pm to 6.00 pm only School of Transportation and Traffic King Street, Randwick
Highway Engineering	Friday 20 February 2.00 pm to 6.00 pm only School of Highway Engineering King Street, Randwick
Other Schools (Engineering)	Friday 20 February 2.00 to 5.00 pm 6.00 pm to 8.00 pm Office of the appropriate School

Graduate School of Engineering

Graduate Study

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

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

The Master of Engineering Science/Master of Surveying Science are faculty-wide degrees, and allow for flexibility of choice between formal course work and research together with the possibility of interdisciplinary studies.

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

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

The conditions for the award of the various higher degrees and graduate diplomas are given in the Calendar.

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

1. formal course work; or

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

3. completion of a research thesis.

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

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

Under the credit system in operation in the Faculty, one credit is normally equal to one hour's attendance per week for one session. The qualification "normally" is required because of the varying ways in which credits are distributed for course work, design, critical review or research in the different schools. A minimum of *thirty-six* credits is required for the Master of Engineering Science and Master of Surveying Science degrees in the Faculty.

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

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

School of Civil Engineering

		Credits
8.701G	Decision Making in Civil Engineering	3
8.702G	Netwrok 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
8.708G	Finite Element Methods in Civil Engineering I	3
8.709G	Finite Element Methods in Civil Engineering II	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
8.752G	Terrain Engineering	6
8.753G	Soil Mechanics I	3
8.754G	Soil Mechanics II	3
8.755G	Materials of Construction I	3
8.756G	Materials of Construction II	3
8.758G	Soil Mechanics III	3
8.759G	Rock Mechanics	6
8.760G	Materials Construction III	3
8.761G	Advanced Rock Mechanics	6
8.763G	Rock Mechanics Investigation	3
8.764G	Composites in Civil Engineering	3
8.766G	Welding in Structural Engineering	3
8.768G	Fracture Mechanics	3
8.771G	Foundation Engineering	6
8.802G	Elastic Stability I	3
8.803G	Elastic Stability II	3
8.804G	Vibrations of Structures I	3
8.805G	Vibrations of Structures II	3
8.806G	Prestressed Concrete I	3
8.807G	Prestressed Concrete II	3
8.808G	Prestressed Concrete III	3
8.809G	Reinforced Concrete I	3
8.810G	Reinforced Concrete II	3
8.811G	Reinforced Concrete III	3
8.812G	Plastic Analysis and Design of Steel Structures I	3
8.813G	Plastic Analysis and Design of Steel Structures II	3
8.814G	Analysis of Plates and Shells	3
8.815G	Computer Analysis of Frames I	3
8.816G	Computer Analysis of Frames II	3
8.817G	Experimental Structural Analysis I	3
8.818G	Bridge Design I	3
8.819G	Bridge Design II	3
8.830G	Hydromechanics	3
8.831G	Closed Circuit Flow	3
8.832G	Pipe Networks & Transients	3
8.833G	Free Surface Flow	3
8.834G	River & Estuarine Hydraulics	3
8.835G	Coastal Engineering I	3
8.836G	Coastal Engineering II	3
8.837G	Hydrological Processes	3
8.838G	Hydrological Design	3
8.839G	Advanced Methods of Flood Estimation	3
8.840G	Hydrological Models and Data Synthesis	3
8.841G	Hydrometeorology	3
8.842G	Groundwater Hydrology	3
8.843G	Groundwater Hydraulics	3
8.844G	Soil-Water Hydrology	3
8.845G	Investigation of Groundwater Resources	6
8.847G	Water Resources Policy	3
8.848G	Water Resources System Design	3
8.849G	Irrigation	3
8.850G	Drainage of Agricultural Lands	3
8.851G	Unit Operations in Public Health Engineering	3
8.852G	Water Distribution and Sewage Collection	3
8.853G	Public Health Science	6
8.855G	Water and Wastewater Analysis and Quality Requirements	3
8.856G	Water Treatment	3
8.857G	Sewage Treatment and Disposal	3
8.858G	Water Quality Management	3
8.901G	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 will not normally be approved in the School of Civil Engineering.

The School of Civil Engineering Graduate Studies Handbook should be consulted for the final list of subjects offered in 1976.

School of Electrical Engineering

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

6.050G	Occasional Elective
6.053G	Advanced Mathematics II
6.054G	Numerical Computation
6.071G	Electrical Measurements
6.073G	Precise Electrical Measurements
6.074G	Superconductivity
6.075G	Electric Contacts
6.150G	Communication Elective
6.160G	Field Theory in Electrical Engineering
6.161G	Field Mapping
6.164G	Microwave Radiators and Applications

6.166G	Wave Propagation Theory	
6.167G	Microwave Transmission Theory	
6.169G	Microwave Circuits: Theory and Techniques	
6.170G	Microwave Electronics	
6.171G	Network Synthesis	
6.172G	Advanced Network Synthesis	
6.224G	Electrical Insulation Engineering	
6.225G	Electrical Discharges and their Technical Applications	
6.226G	Electrical Apparatus Design	
6.234G	Power System Protection	
6.244G	Power Systems I	
6.245G	Power Systems II	
6.246G	Power System Operation and Control	
6.250G	Power Elective I	
6.251G	Power Elective II	
6.254G	Electrical Machines I	
6.255G	Electrical Machines II	
6.256G	Underground Transmission	
6.257G	Electric Power Distribution Systems	
6.341G	Signal Analysis and Transmission Through Networks and Systems	
6.342G	Information and Communication Theory	
6.343G	Modulation Theory and Application to Systems	
6.344G	Optimal Design of Communication Systems	
6.345G	Active and Adaptive Circuits for Integrated Systems	
6.346G	Acoustics	
6.350G	Solid State Electronics Elective	
6.370G	Solid State Theory I	
6.371G	Solid State Theory II	
6.373G	Semiconductor Devices	
6.375G	Integrated Circuit Technology	
6.376G	Reliability Engineering	
6.377G	Integrated Circuit Design	
6.378G	Solar Energy Conversion	
6.381G	Biology and Physiology for Engineers	
6.382G	Biomedical Engineering	
6.452G	Principles of Feedback Control	
6.453G	Optimization in Systems Engineering	
6.455G	System Identification and Modelling	
6.456G	General Concepts in Formal System Theories	
6.457G	Cybernetic Systems Theory	
6.458G	Pattern Recognition Systems	
6.459G	Control Computing	
6.460G	Real Time Computing	
6.461G	Large Scale Systems	
6.464G	Stochastic Processes in Automatic Control	
6.466G	Advanced Linear Control Theory	
6.470G	Advanced Topics in Control	
6.650G	Computer Science Elective	
6.651G	Digital Electronics	
6.654G	Switching Theory and Digital Systems	
6.655G	Computer Organization and Architecture	
6.656G	Software Systems A	
6.657G	Software Systems B	
10.061G	Advanced Mathematics I	
10.361G	Statistics	
*6.909G	Project	9 credits
6.918G	Research Project	18 credits
6.936G	Research Project	36 credits

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

School of Highway Engineering

		Credits
20.041G	Road Location and Design Part I	6
20.042G	Road Location and Design Part II	6
20.052G	Road Location and Design Part II (Surveyors)	6
20.121G	Soil Analysis, Pavement and Bridge Foundation Design Part I	3
20.122G	Soil Analysis, Pavement and Bridge Foundation Design Part II	3
20.131G	Road Construction Part II (Surveyors) (Soil Engineering for Highways)	6
20.211G	Road Construction Part I	6
20.212G	Road Construction Part II	6
20.213G	Road Construction Part III (Surveyors)	6
20.221G	Road Construction Part I (Surveyors)	6
20.311G	Highway Structures Part I	3
20.312G	Highway Structures Part II	3
20.421G	Law and Administration	6
20.430G	Highway Engineering Elective I	3
20.431G	Highway Engineering Elective II	3
20.501G	Management for Highway Engineers	6
20.909G	Project	9
20.918G	Research Project	18
20.936G	Research Project	36

School of Mechanical and Industrial Engineering

		Credits
5.045-6-7G	Advanced Topics in Mechanical Engineering	2, 2, 2
5.072G	Ordinary Differential Equations in Mechanical engineering	2
5.075-6G	Computation Methods in Mechanical Engineering I, II	2, 2
5.077-8G	Analogue Computation in Mechanical Engineering I, II	2, 2
5.085G	Tensors	2
5.101-2G	Optimisation Methods for Mechanical Engineers I, II	2, 2
5.106G	Mechanical Design Against Fatigue	2
5.110G	Morphology of Design	4
*5.151-2G	Refrigeration and Air Conditioning Design I, II	3, 3
5.304-5G	Advanced Dynamics I, II	2, 2
*5.321-2G	Automatic Control I, II	2, 2
5.328-9G	Control and Modelling of Mechanical Systems I, II	2, 2
5.335G	Vibrations	2
5.401G	Experimental Stress Analysis	2
5.421-2G	Advanced Mechanics of Solids I, II	2, 2
5.423-4G	Advanced Mechanics of Solids III, IV	2, 2
5.428-9G	Advanced Mechanics of Materials I, II	2, 2
5.491-2G	Biomechanics I, II	2, 2
5.621-2G	Gasdynamics I, II	2, 2
5.631-2G	Lubrication Theory and Design I, II	2, 2

		Credits
*5.712-3G	Convection Heat Transfer I, II	2, 2
5.718G	Conduction Heat Transfer	2
5.719G	Radiation Heat Transfer	2
5.725G	Statistical Thermodynamics	2
5.735G	Direct Energy Conversion	2
*5.751-2G	Refrigeration, Air Conditioning and Cryogenics I, II	2, 2
*5.758G	Refrigeration and Air Conditioning Applications	4
5.909G	Project	9
5.912-3G	Naval Hydrodynamics I, II	2, 2
5.918G	Research Project	18
†5.936G	Research Project	36

*Candidates wishing to specialize in Refrigeration and Air Conditioning should select these subjects.

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

Department of Industrial Engineering

		Credits
18.061G*	Industrial Experimentation I	3
18.062G*	Industrial Experimentation II	3
18.073G*	Ergonomics	2
18.171G*	Inspection and Quality Control	3
18.271G*	Theory of Machining and Forming Processes	3
18.272G*	Technology of Machining and Forming Processes	3
18.371G*	Factory Design and Layout	3
18.461G*	Design for Production	4
18.462G*	Industrial Design	2
18.463G*	Tool Design	4
18.471G*	Design Communication	2
18.472G*	Engineering Design Analysis	6
18.571G	Operations Research I	6
18.574G	Operations Research II	3
18.671G	Decision Theory	3
18.761G	Simulation in Operations Research	2
18.770G	Stochastic Control	3
18.772G	Information Processing Systems in Organisations	2
18.773G	Optimal Control in Operations Research	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
18.871G	Mathematics for Operations Research	2
18.872G	Mathematical Programming A	2
18.873G	Mathematical Programming B	2
18.874G	Dynamic Programming	2
18.875G	Geometric Programming	2
18.876G	Advanced Mathematics for Operations Research	2
18.877G	Large-scale Optimisation	2
18.960G	Production Engineering Seminar	0
18.967G	Advanced Topic in Production Engineering	2
18.968G	Advanced Topic in Production Engineering	2
18.969G	Advanced Topic in Production Engineering	2
18.970G	Operations Research Seminar	0
18.977G	Advanced Topic in Operations Research	2
18.978G	Advanced Topic in Operations Research	2
18.979G	Advanced Topic in Operations Research	2
18.909G	Project	9
18.918G	Research Project	18
18.936G†	Research Project	36

Candidates taking their Project in Operations Research will generally be required to take 18.571G, 18.574G, 18.871G and 14.062G Accounting for Engineers.

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

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

School of Nuclear Engineering

Each subject counts as three credits.

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

School of Surveying

		Credits
29.106G	Special Topic	
29.154G	Adjustment of Observations	6
29.163G	Mathematical Methods 1	3
29.164G	Mathematical Methods 2	3
29.165G	Mathematical Methods 3	3
29.215G	Geometrical Geodesy	3
29.216G	Geodetic Surveying	3
29.223G	Dynamic Geodesy	3
29.224G	Physical Geodesy	6
29.314G	Geodetic Astronomy	6
29.517G	Theory of Optical-Mechanical Photogrammetric Orientation	3
29.518G	Theory of Analytical Photogrammetric Orientation	3
29.519G	Photogrammetric Instrumentation. .	3
29.520G	Photogrammetric Production Processes	3
29.521G	Aerial Triangulation	3
29.522G	Block Adjustment	3
29.909G	Project	9
29.918G	Research Project	18
29.936G	Research Project	36

School of Transportation and Traffic

		Credits
19.101G	Applications and Practice of Traffic Engineering	6
19.111G	Theory of Traffic Behaviour	6
19.121G	Theory and Practice of Statistics for Traffic Engineers	6
19.131G	Land Use and Transport Planning	6
19.141G	Transport System Analysis	6
19.151G	Economics of Transport	3
19.909G	Project	9
19.918G	Research Project	18
19.936G	Research Project	36

Graduate Diplomas in Engineering

The Faculty of Engineering also offers courses leading to the award of a graduate diploma in several areas. Currently these are Graduate Diplomas in Engineering Developments; in Highway Engineering; in Human Communication; in Industrial Engineering; and in Transport. Candidates must complete a program totalling 30 credits, the number of credits for each subject being determined by Faculty on the recommendation of Heads of Schools; normally one credit is equal to attendance for one hour per week for one session. Forty percent of the credits may consist of approved undergraduate subjects and the program may contain subjects from other schools of the faculty, other faculties of the university and other universities or institutions. Before enrolment, an applicant must submit his intended program for approval by the head of the school or division which will offer the majority of the credits and ensure that he has the necessary prerequisite background for any subjects taken in other schools, faculties or institutions.

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

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

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

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

School of Highway Engineering		**Credits**
20.002G	Soil Mechanics applied to Road Engineering	8
20.003G	Road Engineering Practice	8
20.061G	Road Location and Design Part I	7
20.062G	Road Location and Design Part II	7
20.231G	Road Construction	6
20.232G	Highway Materials	6
School of Mechanical and Industrial Engineerin		
18.081G	Industrial engineering I	8
18.082G	Industrial Engineering II	10
18.681G	Engineering Economic Analysis	3
18.081G	Industrial Computations	6
14.001	Introduction to Accounting A	2
14.002	Introduction to Accounting B	1
14.042G	Industrial Law	2
14.062G	Accounting for Engineers	2
School of Transportation and Traffic		
19.161G	Characteristics of Transport	6
19.171G	Fundamentals of Transport Economic	6
19.181G	Introduction to Statistics	6
19.191G	Introduction to Traffic Theory	6
19.211G	Fundamentals of Transport Planning	6
19.221G	Traffic Operation and Control	6

Division of Postgraduate Extension Studies*

Human Communication

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

		Credits
97.001G	Linguistics and the art and Practice of Written and Spoken Communication	2
97.002G	Basic Information Theory	6
07.004G	Psychology of Communication	3
97.005G	Audio and Video Equipment—Capabilities and Applications	4
97.006G	Project	6
97.007G	Audio Video Signals in Communication	3
97.008G*	Signals-Body in Communication	2
97.009G	Presentation of Information	4

*Half-session only.

Subjects offered by Tape Correspondence

5.075G	Computational Methods in Mechanical Engineering, Part 1	2
5.076G	Computational Methods in Mechanical Engineering, Part 2	3
6.345G	Active and Adaptive Circuits for Integrated Systems	3
6.373G	Semiconductor Devices	3
6.376G	Reliability Engineering	3
6.377G	Integrated Circuit Design	3
6.378G	Solar Energy Conversion	3
8.708G	Finite Element Methods in Civil Engineering	3
97.031G	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
97.039G	Presentation of Information	2
97.010G	Basic Fortran	2

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

Subject Descriptions and Textbooks

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

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

Information Key

The following is the key to the information supplied about each subject listed below: S1 (Session 1); S2 (Session 2); S1 + S2 (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).

Identification of Subjects by Numbers

Each subject provided by a School has an identifying number. The integer is the identifying number of the School and the numbers after the decimal point distinguish the subject from others conducted by that School, some of which may have the same name. For example, Physics I has several variations. The subject number 1.001 denotes Physics I and is the physics subject included in first year Applied Science, Science and Engineering course programs; 1.011 is the corresponding subject at a higher level; 1.081 is the special Physics I subject included in the first year Medicine course; and so on.

As well as providing a clear means of identifying subjects with the same or similar names, the subject number is also used in the recording of enrolment and examination information on machine data processing equipment. It is therefore emphasized that students should cite both the correct subject name, subject number and course code in all correspondence or on forms dealing with courses.

You should become familiar with the identifying numbers of the subjects listed in this handbook:

Identifying Number	School, Faculty or Department
1	School of Physics
2	School of Chemistry
4	School of Metallurgy
5	School of Mechanical and Industrial Engineering
6	School of Electrical Engineering
8	School of Civil Engineering
10	School of Mathematics
14	School of Accountancy
15	School of Economics
18	Department of Industrial Engineering
19	School of Transportation and Traffic
20	School of Highway Engineering
22	School of Chemical Technology
23	School of Nuclear Engineering
27	School of Geography
29	School of Surveying
31	School of Applied Physics and Optometry
36	School of Town Planning

See the Calendar for the full list of subjects and their identifying numbers and for summaries of the disciplines taught in each School or Department.

School of Mechanical and Industrial Engineering

Undergraduate Study

5.010
Engineering A — SS L4T2

Engineering Mechanics I: Two and three dimensional force systems, composition and resolution of forces, laws of equilibrium. Statics of rigid bars, pin-jointed frames. Shear force, axial force, bending moment. Simple states of stress. Kinematics of the plane motion of a particle. Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy.

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.

and either

1. *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.

or

2. (Civil Engineering students must take this option) *Introduction to Materials I:* Role of engineering materials in design process. Traditional and new engineering materials. Concepts of stress and strain. Structure of crystalline and amorphous solids. Phase diagrams. Transformations at constant temperature and constant cooling rate. Tensile test. Relationship of macro properties to structure. Compression test. Hardness.

Textbooks

Svensson N. L. *Introduction to Engineering Design* NSWUP
Walshaw A. C. *SI Units in Worked Examples* Longman
and
For *Introduction to Materials Science:*
Gordon J. E. *The New Science of Strong Materials, or Why You Don't Fall through the Floor* Pelican
Scientific American Materials Freeman
and
For *Introduction to Materials I:*
McClintlock F. A. & Ali S. eds *Mechanical Behaviour of Materials* Addison-Wesley
or
Polakowski N. H. & Ripling E. J. *Strength and Structure of Engineering Materials* Prentice-Hall
or
Richards C. W. *Engineering Materials Science* Chapman & Hall
or
Wyatt O. & Dew-Hughes D. *Metals Ceramics and Polymers* C.U.P.
or
Van Vlack L. H. *Elements of Materials Science* 2nd ed Adison-Wesley

5.020
Engineering B — SS L4T2

Co-requisite: 5.010.

Engineering Mechanics II: Further development of Mechanics I together with: Virtual work. Cables and Catenaries. Geometric properties of plane figures. Kinetics of systems of particles; impulse and momentum. Rotation of a rigid body about a fixed axis.

Civil, Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option) *Mechanics of Solids I;* Concepts of stress, strain. Stress and deformation due to axial force; linear and non-linear problems; compound bars. Concepts of stiffness and flexibility. Bending moment and shear force in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

Textbooks

For *Engineering Mechanics II:*
Meriam J. L. *Statics* Wiley
Meriam J. L. *Dynamics* Wiley
(This book required by students enrolled in 5.311 Engineering Mechanics in Year 2 or Stage III)
For *Mechanics of Solids I:*
Hall A. S. *Introduction to Mechanics of Solids* Wiley

5.030
Engineering C — SS L4T2

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

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

1. (Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option) *Production Technology:* Description and appraisal of the processes classified as: forming from liquid or solid, material removal, material joining. Machines. Analysis of the primary functions of the machine tools and an appraisal of their limitations. Principles of operation of common machine tools and illustrations of their use.

2. (Civil Engineering students must take this option) *Introduction to Materials II:* Creep of materials. Relaxation. Fatigue. Experimental techniques. Variability of materials. Temperature effects. Rate of loading. Casting, annealing, normalizing. Physical and mechanical properties of polymers and elastomers including wood.

and Introduction to Engineering Construction: All students are required to visit a nominated construction project as an integral part of the course. Introduction to engineering construction, equipment and methods. The scope of engineering construction, typical projects and decision agents.

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

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

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

5. (Metallurgy students must take this option) *Introduction to Metallurgical Engineering:* History and significance of the exploitation of metals. Ores, mineral economics, mineral processing, and metal extraction and processing methods illustrated by reference to the Australian mineral and metal industries. Properties, uses and applications of metallic materials. The role of the metallurgist in industry and in processing and materials research, and in relation to conservation and the environment

6. (Mining Engineering students must take this option) *Mechanics of Solids I:* As for 5.020 Engineering B.

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

Textbooks

For *Engineering Drawing:*
Robertson R. G. *Descriptive Geometry* Pitman
Thomson R. *Exercises in Graphic Communication* Nelson

For *Production Technology:*
De Garmo E. P. *Materials and Processes in Manufacturing* Macmillan

For *Introduction to Materials II:*
Gordon J. E. *The New Science of Strong Materials* Pelican
Richards C. W. *Engineering Materials Science* Chapman & Hall
Street A. *Metals in the Service of Man* Penguin
or
Polakowski N. H. & Ripling E. J. *Strength and Structure of Engineering Materials* Prentice-Hall
or
Wyatt O. & Dew-Hughes D. *Metals Ceramics and Polymers* C.U.P.

For *Introduction to Systems and Computers:*
Karbowiak A. E. & Huey R. M. eds *Information, Computers, Machines and Man* Wiley

For *Introduction to Metallurgical Engineering:*
Street A. & Alexander W. O. *Metals in the Service of Man* Penguin

For *Mechanics of Solids I:*
Hall A. S. *Introduction to the Mechanics of Solids* Prentice-Hall

For *Introduction to Computing:*
Wirth N. *Systematic Programming: An Introduction* Prentice-Hall

5.032
Experimental Engineering II S1 + S2 L1T1

Prerequisites: 1.001, 5.010, 5.020, 10.001. Co-or prerequisites: 5.311, 6.801, 8.151, 5.611.

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

Textbook

Beckwith T. G. & Buck N. L. *Mechanical Measurements* 2nd ed Addison-Wesley

5.033
Experimental Engineering III S1 + S2 L1T½

Prerequisites: 5.032. Co- or prerequisite: 5.071.

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

Textbook

Freund J. E. *Mathematical Statistics* Prentice-Hall

5.042
Industrial Experience L0T0

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in all BSc(Eng) courses. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

5.043
Industrial Training I
5.044
Industrial Training L0T0

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

5.051
Thesis S1 + S2 L0T6

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

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

5.061
Technical Orientation S1 + S2 L½T0

Designed to inform students of the art and technique of technical communication, the forms of engineering professional work and the nature of the courses of instruction. A major objective is to bring staff and students together in an atmosphere of discussion and enquiry. May include one or two visits to special establishments.

Textbook

Cooper B. M. *Writing Technical Reports* Pelican

5.062
Communications S1 + S2 L2T0

The mathematical theory of communication, followed by the basic techniques of communication by various media, as required by the professional man. Drawings as a means of communication, pictorial sketches and drawings as illustrations, instructions and visual aids. Basic photographic techniques, the grammar of cine film and of television. Library searching, collation of information, preparation of a seminar and relevant visual aids. Techniques of public speaking and chairmanship. Preparation of a technical paper and its illustrations including graphs, charts and tables of data. The work of an editor. Methods of reproducing information. Copyright and fair copying. Computerized data storage.

Production of a short cine film, videotape and slide sequence; pictorial illustrations. Participation in a seminar and writing of a thesis.

Textbook

Rosenstein A. B. et al *Engineering Communications* Prentice-Hall

5.071
Engineering Analysis S1 + S2 L2½T1

Prerequisite: 10.022.

Digital Computer Programming: Numerical Methods—Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations—series and stepwise methods. Solution of partial differential equations—finite difference and iterative methods. Emphasis to be placed on the use of digital computers. Statistics—an introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ_2, t and F. Estimation by moments and maximum likelihood: confidence

interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction of linear regression.

Textbooks

Freund J. E. *Mathematical Statistics* Prentice-Hall
Statistical Tables

5.111 S1 + S2 L2T2
Mechanical Engineering Design I

Prerequisites: 5.010, 5.020. Co- or prerequisites: 5.311, 5.611, 8.151, 8.259.

Introductory lectures illustrating the interdependence of design and technology. Mechanical technology. Interpretation of engineering drawing practice. Philosophy and technique of design. Simple creative design assignments. Basic engineering elements.

Textbook

De Garmo E. P. *Materials and Processes in Manufacturing* Macmillan

5.112 S1 + S2 L2T1
Mechanical Engineering Design II

Prerequisites: 5.111, 5.311, 8.151, 8.259. Co- or prerequisites: 5.331, 5.412, 5.612.

Design for Production: Principles of tolerance specification, standard procedures for gauging, dimensioning and surface finish specification. *Design of Machine Elements:* Application of fundamental principles to the design of common machine elements, such as shafts, springs, bearings, power transmission devices.

Textbooks

Gladman C. A. *Geometric Analysis of Engineering Designs* Aust. Trade Pub 1966
Siddall J. N. *Analytical Decision Making in Engineering Design* Prentice-Hall 1972
Shigley J. E. *Mechanical Engineering Design* 2nd ed McGraw-Hill
or
Deutschman A. D. Michels W. N. & Wilson C. E. *Machine Design* Macmillan

5.113 S1 + S2 L1½T4½
Mechanical Engineering Design III

Prerequisites: 5.112, 5.331, 5.412. Co- or prerequisite: 5.612.

Design Theory and Technique: Fundamental concepts of the design process, decision theory. Process and technique of optimization. Principles of material selection. Special analytical and experimental techniques of engineering design. *Design Practice:* Minor and major creative design projects, application of sophisticated design techniques in major fields of mechanical engineering.

5.301 SS L1T1
Engineering Mechanics

Prerequisites: 1.001, 5.010. Co- or prerequisite: 10.001.

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

Textbook

Meriam J. L. *Dynamics* Wiley

5.303 SS L1T½
Mechanical Vibrations

Prerequisites: 5.311, 10.022.

Periodic motion, Fourier analysis, simple harmonic motion. Laplace Transform and phasor methods. Single degree-of-freedom system (free and forced vibrations). Some vibration-measuring instruments. Vibration insolation.

Multi-degree-of-freedom systems. Systems with negligible damping, Dunkerley's formula. Introduction to beam vibrations.

5.311 SS L1½T1
Engineering Mechanics

Prerequisites: 1.001, 5.010, 5.020. Co- or prerequisite: 10.001.

Kinematics and kinetics of the plane motion of rigid bodies. Absolute motion, relative translational motion and relative angular motion; dynamic equilibrium; work and energy; impulse and momentum.

Textbook

Meriam J. L. *Dynamics* Wiley

5.331 S1 + S2 L1½T½
Dynamics of Machines I

Prerequisites: 5.311, 10.022.

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

Mechanical Vibrations: Simple harmonic motion. One degree of freedom systems, free and forced vibrations, transmissibility and motion isolation. Whirling of shafts. Laplace transform methods and transfer functions.

Textbook

Hirschhorn J. *Dynamics of Machinery* Nelson

5.324 S1 + S2 L2T1
Automatic Control Engineering

Prerequisite: 10.022.

Block diagrams and Laplace transform methods for system analysis. Transfer functions. Response functions. The general criterion for stability. Routh's criterion. Electronic Analogue Computer and its use in system simulation. Nyquist criterion and Nyquist diagrams. Bode diagrams and frequency response analysis. Root locus methods. Types of controller action and their effects on system response. Optimum settings, ultimate period method and maximum gain method. Analysis of several types of pneumatic controllers and other control system components. Application of automatic control to typical mechanical systems.

5.332 S1 + S2 L2T1
Dynamics of Machines II

Prerequisite: 5.331.

Dynamic Response: Vibration of multiple degree of freedom systems. Time domain analysis of single and multiple degree of freedom systems.

Rigid Body Dynamics: Dynamic effects in machinery. Angular momentum and inertia properties in spatial systems. Equations of motion of spatial systems.

Kinematic Analysis and Synthesis: Analysis of complex mechanisms and an introduction to the synthesis of planar mechanisms.

Textbook

Meriam J. L. *Dynamics* Wiley

5.412 Mechanics of Solids I — S1 + S2 L1½T½

Prerequisites: 8.151, 8.259, 10.022.

Three-dimensional stress and strain, principal values, plane stress, plane strain. Theories of failure. Fatigue strength, combined stresses, non-zero mean stress. Shear centre. Unsymmetrical bending of beams, composite beams. Energy methods of analysis of beams, frames and rings; deflections and redundants. Buckling of columns, combined loadings. Torsion of prisms and thin-walled members. Stress distribution in thick-walled cylinders.

Experimental stress analysis, photoelasticity, strain gauges.

Textbook

Timoshenko S. P. & Gere J. M. *Mechanics of Materials* Von Nostrand

5.413 Mechanics of Solids II — S1 + S2 L2T1

Prerequisite: 5.412.

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

Stress Analysis: Experimental stress analysis. Numerical stress analysis.

Plasticity: Elastic and plastic creep. Residual stress. Limit theorems. Slip-line field theory. Metal forming processes.

5.611 Fluid Mechanics/Thermodynamics I — S1 + S2 L2T2

Prerequisites: 1.001, 5.010, 5.020, 10.001. Co- or prerequisites: 5.311, 10.022.

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

Textbooks

Massey B. S. *Mechanics of Fluids* Van Nostrand
Wark K. *Thermodynamics* 2nd ed McGraw-Hill
or
Lee J. F. & Sears F. W. *Thermodynamics* 2nd ed Addison-Wesley
Reynolds W. *Thermodynamics* 2nd ed McGraw-Hill

5.612 Fluid Mechanics/Thermodynamics II — S1 + S2 L2½T1

Prerequisites: 5.311, 5.611, 10.022.

Dimensional analysis similitude and modelling. Fields. Mass and momentum equations. Vorticity, deformation, dilation. 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.

Textbooks

Holman J. P. *Heat Transfer* 3rd ed McGraw-Hill
Chapman A. J. & Walker W. F. *Introductory Gas Dynamics* Holt Rinehart & Winston 1971
Streeter V. L. *Fluid Mechanics* 4th ed McGraw-Hill

5.614 Fluid Mechanics III — S1 + S2 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. Radial flow and axial flow turbomachinery. Design considerations. Cavitation. Matching of component characteristics.

Textbook

No set texts.

5.615 Thermodynamics III — S1 + S2 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.

Textbooks

No set texts.

5.661 Mechanical Engineering III — S1 + S2 L2T1

Prerequisites: 1.001, 5.010, 10.211A.

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

Textbooks

Kay J. M. & Nedderman R. M. *An Introduction to Fluid Mechanics & Heat Transfer* 3rd ed C.U.P.
Rogers G. F. C. & Mayhew Y. R. *Engineering Thermodynamics Work & Heat Transfer* 2nd ed (S.I. Units) Longman 1967

5.800 Aircraft Design — SS L1½T1

Prerequisites: 5.111, 5.311, 8.151, 8.259. Co- or prerequisite: 5.412.

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

Textbook

Bruhn E. F. *Analysis and Design of Flight Vehicle Structures* Tri-State Offset Co 1965

5.801 Aircraft Design — S1 + S2 L2T2

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

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

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

Textbooks

Bruhn E. F. *Analysis and Design of Flight Vehicle Structures.* Tri-State Offset Co.
U.S. Federal Aviation Agency *Federal Aviation Regulations Part 23: Airworthiness Standards.*

5.811
Aerodynamics I — S1 + S2 L2T1

Prerequisites: 5.311, 5.611, 10.022.

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

5.812
Aerodynamics II — S1 + S2 L2T1

Prerequisites: 5.612 or 5.811; 5.303 or 5.331.

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

Textbook

Abbott I. H. & Von Doenhoff, A. E. *Theory of Wing Sections* Dover
Kuethe A. M. & Schetzer J. D. *Foundations of Aerodynamics* 2nd ed Wiley 1959
Perkins C. D. & Hage R. E. *Airplane Performance Stability and Control* Wiley

5.822 — S1 + S2 L1½T½
Analysis of Aerospace Structures I

Prerequisites: 5.311, 8.151, 8.259, 10.022. Co- or prerequisite: 5.412.

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

Textbook

Bruhn E. F. *Analysis and Design of Flight Vehicle Structures* Tri-State Offset Co.

5.823 — S1 + S2 L1½T½
Analysis of Aerospace Structures II

Prerequisites: 5.412, 5.822.

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

Textbook

Megson T. H. G. *Aircraft Structures for Engineering Students* Arnold

5.831
Aircraft Propulsion — S1 + S2 L1½T½

Prerequisites: 5.611, 5.811.

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

Textbook

Hesse W. J. & Mumford N. V. *Jet Propulsion* Pitman

5.911
Naval Architecture — S1 + S2 L2½T1½

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

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

Textbook

Comstock J. P. *Principles of Naval Architecture* Soc. of Naval Architects & Marine Engineers

5.921
Ship Structures I — S1 + S2 L1½T½

Prerequisites: 8.151, 8.259, 10.022. Co- or prerequisite: 5.412.

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

Textbook

Comstock J. P. *Principles of Naval Architecture* Soc. of Naval Architexts & Marine Engineers NY

5.922
Ship Structures II — S1 + S2 L1½T½

Prerequisites: 5.071, 5.412, 5.921.

Buckling of plates and stiffened panels; combined loads; limit analysis. Structural details. Fatigue and brittle fracture. Design for production.

Finite element method. Rational design synthesis: reliability, optimization, computer-aided structural design.

Textbook
As for 5.921.

5.931
Principles of Ship Design IA — S1 L1T½
Modern ship types and developments. The overall design process. Ship structural arrangements.

Textbooks
D'Arcangelo A. M. *A Guide to Sound Ship Construction* Cornell Maritime P.
D'Arcangelo A. M. *Ship Design and Construction* Soc of Naval Architects and Marine Engineers NY

5.932
Principles of Ship Design IB — S2 L1T½
Co-requisite: 5.911 (5.931 full-time only).

Lines plan. Freeboard, tonnage, capacity. Rules of Classification Societies. Preliminary estimate of ship dimensions.

5.933
Principles of Ship Design II — S1 + S2 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.

Textbooks
Buxton I. L. *Engineering Economics and Ship Design* The British Ship Research Association.
D'Arcangelo A. M. *Ship Design and Construction* Soc of Naval Architects & Marine Engineers NY

5.934
Ship Design Project — S1 + S2 L0T3
Prerequisites: All subjects in Years 1, 2 and 3. Co- or prerequisites: 5.922, 5.933, 5.941.

Design of a vessel to provide characteristics of hull form, preliminary general arrangement, lines plan, hydrostatic curves, investigation of stability and trim, structural profile and midship section, capacity, free-board, tonnage, floodable length (if applicable), power requirements, propeller design, investigation of vibration, rudder design and final general arrangement.

Textbook
As for 5.933.

5.941 — S1 + S2 L2½T1½
Ship Propulstion and Systems
Prerequisites: 5.071, 5.951 (full-time only).

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

Textbook
Comstock J. P. *Principles of Naval Architecture* Soc of Naval Architects & Marine Engineers NY

5.951
Hydrodynamics — SS L1½T½
Prerequisites: 5.311, 5.611, 10.022. Co- or prerequisite: 5.071.

Kinematics of fluids: stream function, velocity potential and application. Elementary treatment of equations of motion and examples in hydrodynamics.

Graduate Study

5.045G
Advanced Topic in Mechanical Engineering

5.046G
Advanced Topic in Mechanical Engineering

5.047G
Advanced Topic in Mechanical Engineering
Subjects which may be offered by a Visiting Professor for graduate credit.

5.072G
Ordinary Differential Equations in Mechanical Engineering
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
Computer programming and numerical analysis review. Solution of transcendental equations. Iteration. Extension to systems of equations. Solution of large systems of linear equations: Direct, matrix and iterative methods. Relaxation. Columbus of finite differences. Numerical integration, differentiation.

5.076G
Computational Methods in Mechanical Engineering II
Numerical Solution of ordinary differential equations: Single step and multistep methods. Reduction to first orders. 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

Basic operations; computer components; programming methods, problem check procedures; solution of linear, non linear differential equations; generation of functions of dependent, independent variables; algebraic equations and real roots of polynomials; problem control for slow, high speed repetitive generation, automatic iterative solutions; transfer function simulation.

5.078G
Analogue Computation in Mechanical Engineering II

Use of digital logic elements, computers; interface for parallel hybrid operation control facilities run functions and parameter optimization. Full hybrid, direct on line, operation.

5.085G
Tensors

Vector algebra:dyadic product. Summation notation. Cartesian tensors: algebra and calculus. Application, physical interpretation in fluid mechanics.

5.101G
Optimization Methods for Mechanical Engineers I

Mathematical theories of optimization. Calculus of variation.

5.102G
Optimization Methods for Mechanical Engineers II

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

5.106G
Mechanical Design Against Fatigue

Theoretical aspects of metal fatigue and calculations for uni-, bi- and tri-axial loading. Evaluation of stress concentration. Design of critical machine elements. Case studies.

5.110G
Morphology of Design

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

5.151G
Refrigeration and Air Conditioning Design I
5.152G
Refrigeration and Air Conditioning Design II

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
5.305G
Advanced Dynamics II

Revision of Engineering Mechanics. Velocities and accelerations in three-dimensional co-ordinate systems. Moving frames of reference (vector equations). Eulerian angles. Ellipsoid of inertia. Lagrange's equations (various examples including applications to vibrations). Euler's equations of motion. General motion of tops and gyroscopes —stability. Lagrange's equations for impulsive forces. Hamilton's Principle.

5.321G
Automatic Control I
5.322G
Automatic Control II

Transient state dynamics of refrigeration and air conditioning system components. Frequency response methods. Response functions and controller settings. Analogue simulation of refrigeration and air conditioning systems.

5.328G
Control and Modelling of Mechanical Systems I
5.329G
Control and Modelling of Mechanical Systems II

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

Comparison of time, frequency, transform domain techniques for linear systems analysis. Application of language's equations and matrix methods in free, forced multi degree-of-freedom systems Model analysis; numbrical methods. Beam shaft vibrations; approximate methods. Self excited vibrations, stability. Random vibrations. Laboratory work on vibration measurement, testing.

5.401G
Experimental Stress Analysis

Grid technique; Moire fringe method; Strain gauges; photoelasticity; crack detection techniques. Class project.

5.421G
Advanced Mechanics of Solids I
5.422G
Advanced Mechanics of Solids II

Elasticity. Thermal stress. Plasticity. Creep. Experimental, numerical stress analysis.

5.423G
Advanced Mechanics of Solids III
5.424G
Advanced Mechanics of Solids IV

Stress analysis. Plates, shells, discs. Thermal, contact stresses. Inelastic stress. Deformation, buckling of bars, rings, tubes, beams, shafts. Plastic buckling.

5.428G
Advanced Mechanics of Materials I
5.429G
Advanced Mechanics of Materials II

Plasticity. Creep. Fracture mechanics. Fatigue. Stress concentration.

5.491G
Biomechanics I
5.492G
Biomechanics II

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

5.621G
Gasdynamics I
5.622G
Gasdynamics II

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

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

Continuum equations of hydrodynamic lubrication. Journal bearing dynamics. Rolling contacts. Elastohydrodynamic lubrication. Grease lubrication. Plasto-elastohydrodynamic lubrication. Metal forming, cutting lubrication.

5.712G
Convection Heat Transfer I
5.713G
Convection Heat Transfer II

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

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

Thermal radiation properties of materials, black bodies; characteristics of real solids, liquids and gases; radiation exchange between infinite surfaces and between finite surfaces; shape factor for various configurations; radiation in an enclosure; radiation behaviour of gases and vapours. Pyrometry. Solar radiation; solar angles; atmospheric absorptions of solar radiation; direct and diffuse radiation; pyrheliometers.

5.725G
Statistical Thermodynamics

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

Magneto-hydrodynamics (M.H.D.): governing equations, ionisation seeding of working gas; material property limitations; fossil, nuclear fuelded M.H.D. generator combined with conventional steam plant. Fuel cells: electro chemical fundamentals; maximum work, Gibbs function, enthalpy of formation, equilibrium constant, e.m.f., limitations, polarization, existing types. Thermoelectric generators: theory of irreversible thermodynamics, Onsager coefficients, coupled phenomena, Peltier, Thomson, Seebeck effects, thermal efficiency, max. power output; design of thermodynamic generator, thermoelectric cooler, magneto-thermoelectricity; radioisotope, solar powered generators; semi conductors, basic ideas of quantum physics, Fermi level and energy bands. *Other modes of direct energy conversion:* photovoltaic; thermionic, Nernst effect generator.

5.751G
Refrigeration, Air Conditioning and Cryogenics I
5.752G
Refrigeration, Air Conditioning and Cryogenics II

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

5.758G
Refrigeration and Air Conditioning Applications

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

5.912G
Naval Hydrodynamics I
5.913G
Naval Hydrodynamics II

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

5.936G
Research Thesis

School of Electrical Engineering

Undergraduate Study

6.010
Electrical Engineering I — SS L2T4

An orientation subject to acquaint students with the various areas and problems of Electrical Engineering. Secondary school physics and maths applied to some aspects of energy conversion and transmission; electronics; logic, number systems, and computers; systems and circuit theory; probability, information and communication. Laboratory exercises and project work in these areas including instrumentation and device characteristics.

6.021A
Basic Circuit Theory — SS L2T2

Prerequisites: 1.001, 6.010, 10.001.

Lumped modelling concepts used in circuit theory and their relationship to observed physical properties and behaviour. Linear circuit elements. Kirchhoffs Laws. Resistive network topology and systematic derivation of network equations using node and loop methods. Network theorems. Exponentials and first order transients. sinusoidal steady state operation including phasors, impedance and admittance concepts and systematic circuit equations. Power relations and second order systems response. Resonance, A factor and bandwidth. Three phase circuits. Controlled sources and two port analysis

Textbook

To be advised.

6.021B
Introduction to Electromagnetic Energy Conversion — SS L2T2

Prerequisite: 6.021A

An introduction to devices which utilise the interaction of electric and magnetic fields. Topics treated include a revision of three phase circuit analysis, magnetic circuits, transformers, electromechanical energy conversion, direct-current and alternating-current machines and their applications.

Textbook

To be advised.

6.021C
Electronics — SS L2T2

Prerequisite or co-requisite; 6.021A.

The principles of operation of discrete electronic devices, sufficient to permit their effective modelling for the purpose of circuit design. Illustration of device modelling in some specific circuit applications. Digital and analogue integrated circuits, including operational amplifiers, and their application in electronic equipment. Design considerations in equipment, including thermal effects and signal/noise ratio.

Textbook

To be advised.

6.021E
Digital Logic — SS L2T2

Prerequisites: 10.001.

Number Systems, codes, error detection. Switching algebra, combinational analysis and synthesis of switching circuits, simplification of switching functions. Clocked sequential circuits, flow diagrams, flow tables, state minimization, secondary assignment. Digital system design at the register-transfer level.

Logical organization of computers. Memory, control units, arithmetic units. Instruction sets in computers, assembler programming.

Textbook

Booth T. L. *Digital Networks and Computer Systems* Wiley

6.022
Electrical Engineering Materials — SS L3T1

A survey of materials and their technology for electrical and electronic devices and systems. Influence of molecular structure on the relevant properties of metals, semiconductors, glasses, ceramics, polymers, liquids and gases, with particular regard to their electrical, magnetic, mechanical, optical and transducing characteristics and their behaviour in electrostatic, magnetic, electromagnetic and thermal fields. Properties of thin and thick films. Control of material properties through heat-treatment, additives, impregnation, etc. Fabrication, forming and deposition methods. Composite materials, joining and bonding techniques. Failure mechanisms and long-term stability. Effects of environment; corrosion; radiation damage. Stabilising and protective treatments. Example applications to illustrate selection criteria, including cost-effectiveness, for specific purposes, including both traditional applications as well as some of contemporary interest.

Textbook

To be advised.

6.031A S1 + S2 L2T2
Systems and Circuit Theory

Prerequisite: 6.021. Co-requisite: 10.111A, 10.111B.

Basic circuit theory including components, singularity functions and time domain analysis of linear dynamic circuits. Convolution. Time and steady-state frequency domain relationships. State equations. Laplace transforms. Network functions, poles and zeros. Network theorems. Properties of feedback systems. Static and dynamic performance. Stability analysis. Bode plots and root locus. Two port analysis. Distributed circuit theory and transmission lines.

Textbooks

Chipman R. A. *Transmission Lines* Schaum's Outline Series McGraw-Hill
Desoer C. A. & Kuh E. S. *Basic Circuit Theory* McGraw-Hill
Di Stepheno III J. J. Stubberud A. R. & Williams I. J. *Feedback and Control Systems* Schaum's Outline Series McGraw-Hill

6.031B S1 + S2 L2T2
Energy Conversion, Transmission and Utilization

Prerequisite: 6.021. Co-requisite: 6.031A.

Introduction to energy conversion; electromagnetic machines, transformers. Power transmission, power systems. Utilization of electrical energy; motors and industrial drives; rotating and other high power amplifiers; a.c.-d.c. conversion; rating of plant; tariffs. Earthing, protection and electrical safety.

Textbook

Fitzgerald A. E. Kingsley C. & Kusko A. *Electric Machinery* 3rd ed McGraw-Hill

6.031C S1 + S2 L2T2
Electronic Circuits and Signal Processing

Prerequisite: 6.021. Co-requisite: 6.031A.

Characterization of transistors and other active devices. Small signal amplifiers, wide band, direct-coupled, tuned. Regulated power supplies. Wave shaping circuits, typical logic circuits, gates. Power amplifiers Classes A, B and C. Oscillators sinewave and limit cycle. Demodulation. Introduction to aerials and propagation. Modulation, need and types. Simple radio transmitter and receiver. Rectifiers and inverters: single and polyphase.

Textbooks

Millman J. & Halkias C. *Integrated Electronics: Analog and Digital Circuits and Systems* McGraw-Hill
Tobey G. E. Graeme J. G. & Huelsman L. *Operational Amplifiers: Design and Application* ISE McGraw-Hill

6.031D
Computing SS L2T2 *or* S1 + S2 L1T1

Prerequisite: 10.001.

Number Systems, codes, error detection. Switching algebra, combinational analysis and synthesis of switching circuits, simplification of switching functions. Clocked sequential circuits, flow diagrams, flow tables, state-minimization, secondary assignment. Digital system design at the register-transfer level.

Logical organization of computers. Memory, control units, arithmetic units. Instruction sets in computers, assembler programming.

Textbook

Booth T. L. *Digital Networks and Computer Systems* Wiley

6.031E SS L2T2 *or* S1 + S2 L1T1
Electron Physics and Devices

Prerequisite: 6.021. Co-requisites: 6.031A, 6.031C.

Classification of solids. Bond model of semiconductors, electron and hole conduction; donors and acceptors, equilibrium carrier densities. Band theory of solids; wave mechanics of electrons, density of states. Statics. Boltzmann and Fermi-Dirac distributions. Electrons in steady state electric and magnetic fields; effective mass; hole conduction. Electron lattice interactions. Generation and recombination of carriers, diffusion, drift. P-N junctions, surfaces and metal-semiconductor contacts. Junction transistor, power transistors and thyristors, field effect transistors, tunnel diodes. Valves and gas discharge tubes. Luminescent materials and lasers. Ferromagnetism, dielectrics, superconductivity.

Textbook

Millman J. & Halkias C. *Integrated Electronics: Analog and Digital Circuits and Systems* McGraw-Hill

6.041
Fields and Measurements SS L2T3

Prerequisite: 6.031A

Fields: Applications of field theory not elsewhere treated in the course, selected from: elements of incompressible fluid magnetohydrodynamics; some engineering applications of magnetostatics; analogies between the telegraphist's equations and a variety of potential theory problems, particularly non-electrical; superconductivity.

Textbook

To be advised.

Measurements: Principles of electrical measurements of moderate precision using direct currents and alternating currents of frequency such that lumped circuit techniques are satisfactory.

Textbook

Stout M. B. *Basic Electrical Measurements* Prentice-Hall

6.042 SS L2T3
Circuits, Signals and Information Theory

Prerequisites: 6.031A, 10.033, 10.361.

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

Textbook

Karbowiak A. E. *Theory of Communication* Oliver & Boyd

6.043
Electrical Measurements S1 + S2 L1T1

Prerequisite: 6.031A.

Measurements section of 6.041 Fields and Measurements.

Textbook

Stout M. B. *Basic Electrical Measurements* Prentice-Hall

6.044 SS L2T3
Electrical Product Design and Reliability

The design and development of reliable, high-quality hardware, from components to systems: product and procurement specifications; factors in choice of system configuration, materials, components, processes, prediction of reliability, availability, system effectiveness; cost-of-ownership optimization; maintainability; thermal design; mechanical design; interconnection and assembly methods; redundancy; ergonomics; design reviews; fault-free 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.

Textbook

Printed notes will be issued.

6.202
Power Engineering—Systems I SS L2T3

Prerequisites: 6.031A, 6.031B.

An elective emphasizing parameters and performance of power system components: transmission lines, power system overvoltages, transformers, fault calculation, circuit interruption, protection.

Textbook

Stevenson W. D. *Elements of Power System Analysis* 2nd ed McGraw-Hill

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 control; power systems in society; distribution systems.

Textbook

Stevenson W. D. *Elements of Power System Analysis* 2nd ed McGraw-Hill

6.212
Power Engineering—Utilization SS L2T3

Prerequisite: 6.031B. Co-requisite: 6.322.

Topics include: Machines and electrical drives, applications and control, a.c. d.c. conversion; rating of plant; industrial heating; frequency changing; illumination. A program of experimental projects and applications of design will accompany the lectures.

6.222 SS L2T3
High Voltage and High Current Technology

Prerequisite: 6.202.

An elective concerned with aspects of design and testing of high power electrical equipment. Topics selected from: fields and materials in high voltage apparatus: effects of high currents; design testing and measurement; effects of transients, earthing; applications of superconductivity.

6.303
Communication Electronics SS L2T3

Prerequisites: 6.031A, 6.031C, 6.031E.

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

6.313
Wave Radiation and Guidance SS L2T3

Prerequisite: 6.031A.

A selection from the following topics:

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

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

6.322
Electronics SS L2T3

Prerequisites: 6.031A, 6.031C.

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

6.323
Signal Transmission SS L2T3

Prerequisites: 6.031A, 6.031C. Co-requisite: see note.

Transmission System Environment: noise distortion; bandwidth; interference; multipath, fading; transmission media. *Analog Transmission:* baseband; linear and non linear modulation principles and techniques; Hilbert transforms; envelopes; DSB, SSB, FM, PM; asynchronous and coherent demodulation, threshold. Transmitters and receivers. Pulse modulation; sampling techniques; aliasing; interpolation filters. *Digital Transmission:* A/D, D/A conversion; quantization errors; compandors PCM; delta modulation. Multilevel transmission; bandwidth; SNR exchange. Elementary detection theory; error probability. Synchronization; regenerative repeaters. Coding. Data transmission; modems; OOK, FSK, PSK; demodulation; matched filters. Intersymbol Interference; equalization; eye patterns. *Multiplex Systems:* FDM, TDM: random access techniques; noise power ratio.

Note: A working knowledge of elementary Fourier transforms and of elementary probability is assumed. 6.042 is recommended as a co-requisite.

6.333 Communication Systems — SS L2T3

Prerequisites: 6.031A, 6.031C.

Sound Systems: Psychoacoustics, loudness, pitch, masking, binaural effects, characteristics of speech, bandwidth and intelligibility. Sound sources, piston radiator, exponential horn. Acoustic and mechanical equivalent circuits, transducers. Introduction to room acoustics. *Telephone, Telegraph and Data Systems:* General principles, multiplexing, carrier systems, code, speech and data transmission, telemetry, facsimile. *Television Systems:* Physiological aspects of television, television standards, colour systems, transmitters, receivers. *Radar:* Principles of pulse and C.W. radar, distance and direction measuring equipment for navigation and surveying.

Textbooks

Patchett G. N. *Colour Television* Norman Price
or
Townsend B. *PAL Colour Television* C.U.P.
Showalter L. C. *Closed Circuit T.V. for Engineers and Technicians* Sams & Co.
Skolnik M. I. *Introduction to Radar Systems* McGraw-Hill

6.383 Biomedical Engineering — SS L2T3

Prerequisites: 6.031A, 6.031C.

A course designed to introduce electrical engineering students to the practice of engineering techniques applied to the biological and medical fields. The lectures are supplemented by demonstrations and experimental work, and deal with the basic physiology of cells, tissues, organs and organisms, instrumentation and measurement techniques and modelling of various types of biological systems.

6.412 Automatic Control — SS L2T3

Prerequisites: 6.031A, 6.031B.

Principles and techniques applicable to the analysis and design of continuous and discrete feedback control systems as encountered in industrial processes. Frequency, transform and time domain methods for compensation and stability analysis of single-input single-output linear systems. Extension to some common nonlinearities.

Textbook

Stapleton C. A. *Basic Control—Classic and Modern* Univ of N.S.W.
or
Takahashi Y. et al *Control and Dynamic Systems* Addison-Wesley

6.413 Modern Control Engineering — SS L2T3

Prerequisite: 6.412.

A basis for design of multivariable feedback systems using both state-space and frequency-domain methods. State representation of systems (considering linear/nonlinear, discrete/continuous, lumped/distributed, deterministic/stochastic in both time and frequency domains); canonical forms; controllability; observability; identifiability, stability. Performance indices; state and control constraints, penalty functions; sensitivity. Design techniques for linear, time-invariant multivariable systems.

Textbook

To be advised in class.

6.432 Computer Control and Instrumentation — SS L2T3

Prerequisites: 6.031C, 6.031D.

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 viewpoints. Digital instrumentation. Hybrid devices and analog conversion. Computer organization and interfacing concepts. Peripherals. Introduction to software systems for control applications. Computer control of processes via on-line languages.

Textbook

To be advised in class.

6.512 Advanced Semiconductor Device Theory — SS L2T3

Prerequisites: 6.031C, 6.031E.

Semicondutor materials; metal/semiconductor contacts; MIS structures; FETs and their applications; FET models used in computer-aided circuit design; charge-coupled devices; high-frequency bipolar transistor considerations; photoelectronic semiconductor devices; dynamic characteristics of thyristors.

Textbook

Grove A. S. *Physics & Technology of Semiconductor Devices* Wiley

6.522 Transistor and Integrated Circuit Design — SS L2T3

Prerequisites: 6.031C, 6.031E.

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

Textbooks

Lynn D. K. Meyer C. S. & Hamilton P. J. *Integrated Circuits* Vol. II Motorola Series in Solid-State Electronics McGraw-Hill
Warner R. W. & Fordemwalt J. N. *Integrated Circuits* Vol. I Motorola Series in Solid-State Electronics

6.601A Introduction to Computer Science — SS L4T1 *or* S1 + S2 L2T½

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

Textbook

Jensen K. & Wirth N. *PASCAL User Manual and Report* Volume 18 Springer-Verlag

6.601B SS L4T1
Assembler Programming and Non-Numeric Processing

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

Textbooks

PDP11/40 Processor Handbook Digital Equipment Corporation
Griswold R. E. Poage J. F. & Polansky I. P. *The SNOBOL 4 Programming Language* 2nd ed Prentice-Hall
Either
Gray L. D. *A Course in APL/360 with applications* Addison-Wesley
or
Gilman and Rose *APL an Interactive approach* 2nd ed Wiley
or
Polivka and Pakin *APL the language and its usage* Printice-Hall

6.612
Computer Systems Engineering SS L2T3

Prerequisites: 6.031D or 6.602A.

Analysis and design of clocked-sequential and fundamental-mode sequential circuits. Introduction to APL as a 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.

Textbook

Hill F. J. & Peterson G. R. *Digital Systems: Hardware Organization and Design* Wiley

6.622
Computer Application and Software SS L2T3

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

Textbooks

No set Texts.

6.801
Electrical Engineering S1 + S2 L1T2

Prerequisite: 1.001.

Illustrates the application of electrical engineering to other disciplines such as mechanical and civil engineering, industrial chemistry and geophysics. The only basic electrical theory considered is that necessary for an understanding of the applications. The course is divided into two sections, each of which contains an inter-disciplinary applications-oriented project.

SESSION 1
Principles of circuit theory and analog computing. Amplifiers, their specification and application. Transducers. Electronic instrumentation. Industrial data acquisition.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

SESSION 2
Principle of circuit theory. Transformers Electrical machines, their selection, control and application in industrial environments. Elements of the utilization and distribution of electrical power.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

6.802
Electrical Engineering SS L2T1

Prerequisite: 6.801.

Study of electrical and electronic equipment, with emphasis on 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.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

6.822
Electronics S1 + S2 L1T2

Prerequisite: 1.001.

The prime objective of the course is to illustrate the application of electronics to other disciplines, particularly surveying. The only basic electrical theory considered is that necessary for an understanding of the applications. The course contains an interdisciplinary applications-oriented project. The topics covered include: principles of circuit theory and analog computing; amplifiers, their specification and application; modulation; electronic distance measurement.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

6.902
Industrial Experience

A minimum of three years of appropriate industrial experience must be obtained concurrently with attendance in Course 365. Students are required to submit to the School evidence from their employers confirming completion of the prescribed period of industrial training.

6.911
Thesis

For students in the final year of their BE course.

6.931
Group Thesis

For students in the final year of their BE course.

Graduate Study

6.050G
Occasional Elective

This syllabus will change from one occasion to the next, allowing presentation of a modern topic at graduate level, particularly by visiting academics of eminence.

6.053G
Advanced Mathematics II

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

Topics include numerical solution of partial differential equations and approximation theory.

6.071G
Electrical Measurements

Electrical measurements of moderate precision. Theory and practice of deflection measurements and null techniques at D.C. and low audio frequencies.

6.073G
Precise Electrical Measurements

An advanced course primarily devoted to the special problems of precision measurements at D.C. and audio frequencies. Establishment of electrical standards.

6.074G
Superconductivity

The theory of superconductivity and its application. Includes loss mechanisms, a.c. losses, flux jumps, superconducting materials, applications to electrical apparatus.

6.075G
Electric Contacts

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

As for 6.050G.

6.160G
Field Theory in Electrical Engineering

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

The Laplace and Poisson equations: complex variable techniques for 2-dimensional solutions. Graphical, experimental and numerical methods for 2- and 3-dimensional problems. The Helmholtz equation. Cases where solutions may be based on the Laplace equation. Review of selected examples in electrical engineering.

6.164G
Microwave Radiators and Applications

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

6.166G
Wave Propagation Theory

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

6.167G
Microwave Transmission Theory

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

6.169G
Microwave Circuits: Theory and Techniques

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

6.170G
Microwave Electronics

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

6.171G
Network Synthesis

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

6.172G
Advanced Network Synthesis

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

6.224G
Electrical Insulation Engineering

Co-ordinated approach to the design of insulation systems for application at high and low voltages. Basic principles, experiemental and theoretical factors involved in the establishment of particular design criteria. Practical situations and demonstrations.

6.225G
Electrical Discharges and their Technical Applications

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

Based on fundamental concepts and in which thermal, electric and magnetic properties on a macroscopic scale and their interrelationships are displayed in relation to the design of electrical and electronic apparatus.

6.234G
Power System Protection

The theory and application of protective devices and systems, related to the protection of transmission lines, transformers, busbars and generators.

6.244G
Power Systems I

An advanced course dealing with topics such as economic despatch, load flow and stability in large power systems.

6.245G
Power Systems III

An advanced course concerned with some of the following topics: modal propagation on H.V. lines, D. C. transmission; power system transients, communication systems etc.

6.246G
Power System Operation & Control

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.

6.250G
Power Elective I

As for 6.050G.

6.251G
Power Elective II

As for 6.050G.

6.254G
Electrical Machines I
6.255G
Electrical Machines II

These two independent options are concerned with the theory, design operation and control of modern electrical machines.

6.256G
Underground Transmission

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

The engineering problems of distribution systems including industrial power systems, stressing the electrical distribution system as an entity. Distribution system planning. Overall design criteria. Co-ordination of thermal ratings. Protection of distribution network: cables and overhead lines. Design and performance of individual plant items. Particular problems of urban and rural distribution systems. Demonstrations and project work.

6.341G
Signal Analysis and Transmission Through Network and Systems

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

6.342G
Information and Communication Theory

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

6.343G
Modulation Theory and Application to Systems

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

6.344G
Optimal Design of Communication Systems

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

6.345G
Active and Adaptive Circuits for Integrated Systems

Revision of discrete and distributed RC synthesis as a preliminary to the discussion of active elements embedded in RC networks. The synthesis of linear active RC systems (with controlled sources, negative immittance converters, gyrators, etc.), including state-space methods. Sensitivity considerations and integrated realization. Non-linear and time-variable circuits. Adaptive filters for equalization and echo cancelling. Circuit techniques for achieving reliability in integrated circuits.

6.346G
Acoustics

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

6.350G
Solid State Electronics Elective

As for 6.050G.

6.370G
Solid State Theory I

An introductory theoretical discussion of wave mechanics and its application to charge carrier flow in metals and semiconductors including electronic Bloch and Wannier states, effective mass theory. Lattice phonon spectrum, mobility in semiconductors, electron-phonon scattering, scattering by lattice imperfections. Electron-electron interactions. Formal transport theory and the Boltzmann equation.

6.371G
Solid State Theory II

Treatment of certain advanced topics in solid state theory applied especially to semiconductors. Phonon lattice dynamics, anharmonic interactions, thermal expansion, thermal conduction. Further electron-phonon interactions. Electron transport phenomena in a magnetic field, Hall effect, magneto-resistance, thermo-magnetic phenomena, de-Hass-van Alphen effect. Magnetic spin waves or magnons. Spin wave interactions.

6.373G
Semiconductor Devices

Theory and characteristics of semiconductor devices, notably bipolar transistors, field effect transistors, and thyristors. The course discards many of the simplifications and generalizations made in the undergraduate treatment of transistors.

6.375G
Integrated Circuit Technology

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

6.376G
Reliability Engineering

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

6.377G
Integrated Circuit Design

An advanced course on the design of integrated circuits, including the properties and modelling of integrated circuit elements, d.c. and a.c. design of operational amplifiers, lowpass and bandpass circuits, digital gates and complex functions, computer-aided design.

6.378G
Solar Energy Conversion

World and Australian energy resources. Solar energy and the environment. Characteristics of received solar radiation. Thermal conversion (including thermoelectric devices). Selectively absorbing surfaces. Biological methods of conversion. Fundamentals of photovoltaic generation. Present and future applications of photovoltaic cells. Solar energy storage, and system considerations. Solar energy: research for the future.

6.381G
Biology and Physiology for Engineers

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

6.382G
Biomedical Engineering

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

6.452G
Principles of Feedback Control

An intensive series of lectures, laboratory and tutorial, for upgrading at the graduate level those students who are deficient in the basics of control. Material covered includes design of continuous and discrete feedback systems, via classical frequency response and time-domain methods, as well as state space techniques. Nonlinear systems and systems with random inputs.

6.453G
Optimization in Systems Engineering

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

6.455G
System Identification and Modelling

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

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 will include the state properties and basis functions for linear systems; equivalence and reduction, structure, decomposition and interconnection; complexity; accessibility of states and stability considerations.

6.457G
Cybernetic Systems Theory

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

6.458G
Pattern Recognition Systems

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

6.459G
Control Computing

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

An advanced treatment of digital, analog and hybrid computer methods, used to control physical plant in real times. Topics include: hardware techniques and software structures as encountered in industrial applications of small computers, hybrid methods for identification and optimization of systems. Students undertake individual project work, involving the planning and computer realization of specific control problems.

6.461G
Large Scale Systems

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

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

6.464G
Stochastic Processes in Automatic Control

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

6.466G
Advanced Linear Control Theory

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

6.470G
Advanced Topics in Control

Advanced topics taught either by visiting academics or staff members with specific research interest. Typical topics are: design case studies; current research problems and review of important papers; game theory; multi-input-output design. Stochastic control theory. Distributed systems (diffusion, display etc.). Functional analysis.

6.650G
Computer Science Elective

As for 6.050G.

6.651G
Digital Electronics

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

6.654G
Switching Theory and Digital Systems

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

6.655G
Computer Organization and Architecture

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

6.656G
Software Systems A

A theoretical and practical basis for subject matter within the following areas: compiler organization: date structures (table organization, list structures, trees, stacks, etc.), lexical analysis, syntax analysis, code generation, code optimization. Portability: solutions to the problem of moving software systems between different mechanics. Compiler compilers: translator writing systems designed to provide facilities to aid the compiler writer.

6.657G
Software Systems B

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

6.909G
Project

6.918G
REsearch Project

6.936G
Research Project

School of Civil Engineering

Undergraduate Study

8.001
Industrial Training

Requirement for the Bachelor of Engineering degree

Students are required to complete a minimum of sixty working days of approved industrial training and submit a report on this training prior to enrolment in the final year.

8.002
Industrial Experience

Requirement for the BSc(Eng)

A minimum of three years of satisfactory industrial experience must be obtained concurrently with attendance in the course. Students are required to submit to the School on enrolment in the final year evidence from their employers confirming completion of the prescribed period of industrial training.

8.011
Projects Year IV

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

Not compatible with 8.019. Prerequisites: 8.174, 8.182.

An introductory subject in the design of road and railway bridges. Types of bridges, economic spans and proportions. Design loads and codes. Aspects of the design of steel, reinforced concrete, pre-stressed concrete, and composite bridges by empirical, elastic and limit state methods.

Textbooks

Beckett D. *An Introduction to Structural Design (1) Concrete Bridges* Surrey U.P.
Morice P. B. & Little G. *The Analysis of Right Bridge Decks Subjected to Abnormal Loading* C. &UC.A.
N.A.A.S.R.A. *Highway Bridge Design Specification* 1970 Add. no. 1 1972 Metric Add 1973

8.014 — SS L2T1
Computer Applications in Civil Engineering

Prerequisite: 8.273. Co-requisites: 8.753 or 8.191.

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

Textbooks

Cole R. W. *Introduction to Computing* McGraw-Hill
Peterson W. W. & Holz J. L. *Fortran IV and The IBM 360* McGraw-Hill

8.015
Road Engineering — SS L2T1

Prerequisites: 8.272, 8.671, 29.441.

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

8.016
Hydraulics — SS L2T1

Prerequisite: 8.573.

Use of hydraulic models for rivers and coastal works. Further studies in open channel flow and estuarine hydraulics.

8.017
Transportation Engineering — SS L2T1

History, development and characteristics of modes of transport. Fundamentals and evaluation of transport systems, performance and output. Interaction between land use and traffic demand.

8.018
Construction Engineering — SS L2T1

Prerequisite: 8.671.

Advanced construction methods and techniques with special reference to major civil engineering projects under construction in Australia.

8.019
Railway Engineering — SS L2T1

Not compatible with 8.013. Prerequisite: 8.672.

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

8.020
Hydrology — SS L2T1

Prerequisite: 8.582.

Flood estimation with particular reference to design and flood forecasting. Outline of current practices and recent developments. Discussion of possible/likely implications of recent developments for the practising engineer.

8.021 — SS L2T1
Environmental Aspects of Civil Engineering

Prerequisite: 8.301.

A project oriented study with the goal of developing professional awareness of environmental implications of civil engineering activities and decisions.

Textbook

Meadows D. H. et al *The Limits to Growth* Earth Island

8.022
Elasticity and Plasticity — SS L2T1

Prerequisite: 8.174.

Aspects of the elasticity and plasticity theories to solution of stress distribution and stability problems.

8.023
Hydrodynamics — SS L2T1

Prerequisites: 8.571, 10.022.

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

8.024
Foundation and Dam Engineering — SS L2T1

Prerequisite: 8.273

Foundations of structures and dams. Problems. Alternative foundation types. Treatment of foundation soils. Consolidation and drainage. Allowable settlement of structures. Settlement calculations. Design of earth and rock fill dams. Stability during construction and drawdown. Case studies of dam failures. Piping. Erosion.

8.025
Structural Failures — SS L2T1

Prerequisites: 8.174, 8.182.

Case studies of significant structural failures and distress during concept, construction, design and use. Modes, causes, consequences, responsibilities, corrective procedures.

8.026 — SS L2T1
Systems Methods in Civil Engineering

Prerequisite: 8.301.

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

8.027
New Materials I — SS L2T1

Prerequisite: 8.272. Co-requisite: 8.273.

History and development of polymers. Structure of polymeric materials. Properties and applications of thermoplastics and thermosets. Reinforced plastics; Fabrication. Structural Analysis and application to the design of FRP structures. Building adhesives, epoxies and ceramic wall tile fixing. Modified concrete, polymer concrete and glass fibre reinforced cement.

8.028
New Materials II — SS L2T1

Prerequisites: 8.273, 8.182.

Theory and application of fibre reinforcements—glass and steel fibre reinforced cements, mortars and concretes composites. Shrinkage compensated and expansive cements—applications. Utilization of blast-furnace slag. Special aggregates and high strength concretes. New Techniques of testing and removing concrete and reinforced concrete structures.

8.029
Continuum Mechanics — SS L2T1

Prerequisite: 8.172.

Concept of continua, mathematical foundations, analysis of deformation, strain and stress, fundamental laws of continuum mechanics, constitutive equations, mechanical properties of solids and fluids, simple problems in elasticity.

8.030
Construction Management — SS L2T1

Pre- or co-requisite: 8.672.

Civil Engineering Construction organization, management and control.

8.031
Construction Project Finance — SS L2T1

Pre- or co-requisite: 8.672.

Civil Engineering construction project feasibility, financial management, cash flow, cost control, insurance and company finance.

8.032
Law for Builders — SS L2T1

Pre- or co-requisite: 8.672.

Introduction to the law, including brief outline of sources of law in New South Wales and the System of judicial precedent. General principles of law of contract. Some special forms of building contract.

8.033
Industrial Law and Arbitration — SS L2T1

Prerequisite: 8.672.

Introduction to industrial law, including reference to Commonwealth and State statutory provisions dealing with conciliation and arbitration. State and Commonwealth awards. Industrial disputes. Employers' association. Trade unions. Introduction to real property and local government law.

8.034
Engineering Economy — SS L2T1

Pre- or co-requisite: 8.673.

Economic evaluation of civil engineering projects, including benefit-cost analysis and rate of return analysis.

8.035
Flat Slab Design — SS L2T1

Current design methods for flat slabs and two-way slabs, and the background to and limitation of these methods; problem areas in the design of these floor systems and current research activity and its likely effects on future design methods.

8.036
Philosophy of Limit State Design — SS L2T1

Definition and history of the limit state method of structural design. Probabilistics and semi-probabilistic approaches. Limiting criteria. Limit state codes. Application to bridges and buildings.

8.037
Optimum Design of Structures — SS L2T1

Prerequisites: 8.174, 8.182.

Methodology of Design. Formulation of structural optimization models. Discrete and continuous design variables. Fully stressed, minimum weight and minimum cost designs. Mathematical methods of optimization.

8.038 — SS L2T1
Special Topics in Reinforced Concrete Design

Prerequisite: 8.182.

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

8.039
Computer Programming — SS L2T1

Introduction to FORTRAN Programming, use of WATFIV compilers, flow charts and simple problems.

8.040
Advanced Engineering Geology — SS L2T1

Introduction to structural geology rock types. Macro and Micro characteristics base studies. Defects in rocks. Representation of defects. Schmidt diagrams. Laboratory studies.

8.041
Geological Engineering — SS L2T1

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.

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.

8.044
Electrical Instrumentation — SS L2T1

The integration of electrical instrumentation into engineering systems. Provides a basis of circuit theory and elementary electronics and treats analog computers, amplifiers, amplifier systems, instrumentation, data processing and process control.

8.045
Electrical Machinery — SS L2T1

A user-oriented introduction to the usage of electrical power in industry, covering characteristics and selection of electrical machinery, their interface with the prime power supply, protection electrical safety and compliance with Australian standards.

8.046
Town Planning — SS L2T1

The influence of structural technique in the past on architectural styles. Effect of modern structural engineering systems on architecture. Responsibilities of the structural engineer as a consultant.

8.047
History of Civil Engineering — SS L2T1

A study of the theoretical, practical and sociological aspects of the development of civil engineering, including its relationship to other disciplines.

8.051
Design Projects I — SS L0T2½

Final year design projects in the fields of structural engineering and civil engineering materials.

8.052
Design Projects II — SS L0T2½

Final year design projects in the fields of hydraulics, water resources, planning and management.

8.112
Materials and Structures — S1 + S2 L1T2

Theory of Structures—Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strain. Relationship between load shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

Properties of Materials—Mechanical behaviour of materials; response to static and dynamic loads. Laboratory techniques. Analysis and presentation of experimental results. Use of material properties in analysis and design.

8.113 — S1 L2T1½; S2 L1T½
Civil Engineering for Electrical Engineers

Theory of Structures—Stress; strain; elastic and inelastic deformation. Principal stresses and strains. Compound bars and temperature stresses. Direct stresses and shear stresses in beams. Defelction of beams. Torsion of circular and thin-walled sections. Combined bending, twisting and axial force. Instability of bars in compression.

Properties of Materials—Characteristic modes of deformation and fracture of materials under load. Response to steadily applied tension, compression and shear. Response to oscillatory stress, rapidly applied stress and longterm stress. Effect of shape and environmental factors. Critical stress conditions for deformation and fracture. Standard tests of mechanical properties.

Textbooks

Davis H. E. Troxwell G. E. & Wiskocil G. T. *Testing and Inspection of Engineering Materials* McGraw-Hill
Hall A. S *Introduction to the Mechanics of Solids* SI ed Wiley 1973

8.152
Structures S1 + S2 L3T1

1. *Steel Structures:* Introduction to steel as a building material. Safety precautions. Load factors. Factor of safety. Protection of steel structures. Riveted, bolted (including high strength friction grip and mild steel), welded connections. Design of simple tension members. Design of simple plain and built-up-beams including restrictions imposed by lateral instability and local buckling. Design of single columns. Design of integrated beam-columns in rigid frames. Design of simple pin jointed frames. Introduction to elastic design of rigid frames and multi-storey buildings. Implications of code AS 1250—1972 "Steel Structures Code", and associated codes on manual welding, high strength friction grip bolting, dead, live and wind loads on structures.

2. *Concrete Structures:* Introduction to concrete as a building material. Development of reinforced concrete and philosophy of design. Behaviour of beams under pure bending. Working stress method of design. Development of strength equations for pure bending. Design of beams to resist bending moment. Design of continuous beams. Design of beams under bending and shear Development of bending and shear equations. Design of beams for shear. Design of one way slabs. Bond and anchorage. Behaviour of reinforced concrete under axial loads. Strength equations for combined uni-axial bending and axial force. Design simplifications. Interaction diagrams. Analysis and design of columns. Serviceability requirements for concrete structures. Introduction to torsion design. Implications of Coade CA 2 1973 "Concrete in Buildings".

3. *Analysis:* Moment distribution, including sideway with several degrees of freedom. Frames with members which are not mutually orthogonal. Stability, concepts of bifurcation and snap-through, stability of simple mechanicsms with linear material response. Discussion of effects of plastic material response. Virtual work: virtual forces and virtual displacements. Application to trusses. Displacements of statically determinate pin-jointed trusses, matrix methods. Concept of generalized forces, application to truss deflections. Connectivity matrix. Flexibility analysis of simple statically interminate trusses. Calculation of displacements in simple structures by the method of volume integrals. Brief treatment of influence lines for statically determinate and indeterminate structures.

Textbooks

White R. N. & Gergely P. *Structural Engineering* Vol. 2: *Intermediate Structures* Wiley
Winter G. et al. *Design of Concrete Structures* 8th ed McGraw-Hill
Steel Design Course. Part 1: Design of Beams & Columns. Part 2: Tension Members & Plastic Design Australian Institute of Steel Construction North Sydney
AS 1250—1972. SAA Steel Structures Code (Metric Units)
CA2—1973. SAA Concrete Structures Code (Imperial Units)
CA8—Part 1—1965. *SAA Code for Welding in Buildings. Part 1—Manual Welding*
AS 1170.1—1971. *SAA Loading Code. Part 1—Dead & Live Loads* (Metric Units)
ASCA 34—Part II—1971. *SAA Loading Code. Part II—Wind Forces*
ASCA 45—1970. *SAA High Strength Bolting Code*

8.153
Structures S1 + S2 L3T2

Analysis. Work theorems; total potential; theorems of Castigliano, Maxwell, Betti. Plastic analysis of steel; continuous beams, portals. Stiffness analysis of trusses and frames. Structural dynamics. Arches and cable structures. Description of shells and thier structural behaviour. Introduction to finite element theory.

Design of Structures. Design of statically determinate prestressed concrete beams both pre-tensioned and post-tensioned. Calculation of losses; stresses at working loads; evaluation of ultimate flexural strength. Design of end blocks. Application of plastic analysis and design procedures to continuous steel beams and portal frames. Design of joints. Timber design, with emphasis on the special properties of timber affecting the design of timber beams, columns, trusses and joints. Types of retaining walls; gravity, cantilever, counterfort. Calculation of stability. Design of reinforced concrete cantilever walls. Introduction to flat slap design.

Textbooks

A.S. *Code* CA35—1973
A.S. *Code* CA65—1972

8.154
Structures S1 + S2 L1T2

Analysis. The principle of virtual work. Statics. Flexibility analysis of simple frames. Plastic analysis of steel frames. Stiffness analysis of trusses and frames.

Textbook

No set texts.

8.161
Engineering Mathematics S1 + S2 L1¼T1¼

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.

Textbooks

No set texts.

8.171
Mechanics of Solids I

This subject forms part of 5.020 Engineering B and 5.030 Engineering C.

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.

Textbook

Hall A. S. *Introduction to the Mechanics of Solids* SI ed Wiley

8.172
Mechanics of Solids II SS L2T2

Prerequisites: 5.010, 5.020.

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.

Textbook

Hall A. S. *Introduction to the Mechanics of Solids* SI ed Wiley

8.173
Structural Analysis I — SS L2T1

Prerequisite: 8.172.

The analysis of pin-jointed trusses. The principle of work applied to trusses; forces in, and deformation of, statically determinate trusses; statically indeterminate trusses (force method); displacement method of analysis; variational theorems; non-linear analysis.

8.174
Structural Analysis II — SS L2T1

Prerequisite: 8.173.

Force and displacement transformations. Rigid jointed frames and their components; the principle of work applied to frames; forces in, and deformation of, statically determinate frames; force and displacement methods of analysis; moment distribution; moving loads.

8.181
Structural Design I — SS L1T1½

Prerequisites: 5.010, 5.020, 5.030.

Introduction to design concepts, leading to selection of appropriate structural systems. Behaviour of structural members at service loading and in the overload range up to failure. Safety. Simple beams, tension and compression members and connections in timber, concrete and steel. Proportioning of members and connections from basic principles. The objective is an understanding of structural behaviour, and the ability to produce practical and rational designs based on the elementary theory of mechanics of solids.

8.182
Structural Design II — SS L1T2

Prerequisite: 8.181.

Extension of the fundamental concepts developed in Structural Design I to the behaviour and design of more advanced members and structures. Further consideration of safety and design loads including wind and earthquake loading. Some reference to codes of practice, concentrating on the principles behind the more important sections.

Reinforced Concrete: continuous beams and frames; two-way slabs and flat slabs; footings; members subjected to combined axial force and bending moment.

Prestressed Concrete: pre- and post-tensioning; simple beams, design for working loads and ultimate flexural strength; design of end blocks.

Steel: plate girders; moment connections and splices; residual stresses; columns with elastic and restraints; plastic and elastic design of continuous beams and frames.

8.191
Structural Engineering — SS L1½T1½

Prerequisites: 8.174, 8.182.

1. Variational theorems applied to rigid frames; non linear analysis; dynamic analysis. Plastic analysis of steel structures. Brief treatment of finite element methods, cable structures, arches, plates and shells.

2. Timber design. Emphasis on special properties of timber affecting the design of timber structures. Introduction to plastic design of steel structures. Application to continuous beams and portal frames.

8.250
Properties of Materials — SS L2T2

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact. Deterioration of engineering materials. Rheological classification of materials.

Textbook

Polakowski N. H. & Ripling E. J. *Strength and Structure of Engineering Materials* Prentice-Hall

8.252
Civil Engineering Materials — SS L3T1

Prerequisite: 8.272.

Concrete Technology—Properties of concrete and its applications; structure and composition. Rheological properties of fresh concrete. Mechanical properties of hardened concrete. Mix design. Methods of testing constituent materials.

Soil Mechanics—Pressure and movement of soil moisture, effective stress. Consolidation and settlement. Shear strength and testing of soils. Elastic theory of soil stress. Stability of slopes. Lateral earth pressure, retaining walls.

Textbooks

Lambe T. W. & Whitman R. V. *Soil Mechanics* Wiley
Troxell G. E. Davis H. E. & Kelly J. W. *Composition and Properties of Concrete* 2nd ed McGraw-Hill
or
Neville A. *Properties of Concrete* Pitman

8.253
Civil Engineering Materials — S1 + S2 L3T2

The mechanical behaviour of real materials; elasticity, inelasticity, plasticity, anelasticity, and damping. Multiphase theory of elastic behaviour. Theories of failure.

Specifications for and selection of steels. Corrosion and corrosion protection. Structural aluminium alloys, properties, selection, applications and limitations. Polymers. Structural application of reinforced plastics. Wood and composite technology.

Mechanical properties of concrete, Multi-phase theory of elastic behaviour, effect on deflection of structural members. Bond with reinforcement. Volume change. Influence on stress distribution of reinforced and prestressed concrete members and mass concrete. Special requirements in design and construction methods. Durability. Permeability, extensibility and crack resistance. Thermal effects, residual stresses. Physical and chemical deterioration. Concrete manufacture, field control and acceptance. Special non-destructive tests. Special applications.

Foundation engineering. Bearing capacity theory. Allowable settlement of structures. Techniques of settlement prediction. Earth and rockfill embankments. Design of earth dams. Site investigations. Techniques. Design of investigations. Retaining structures. Techniques of soil treatment. Road pavement design.

Laboratory. Measurement of properties of cement and concrete. Mix design. Measurement of engineering soil properties. Minor project.

Textbooks

Lambe T. W. & Whitman R. V. *Soil Mechanics* Wiley
or
Bowles J. E. *Foundation Analysis and Design* McGraw-Hill
Neville A. M. *Properties of Concrete* Pitman
Terzaghi K. V. & Peck R. B. *Soil Mechanics in Engineering Practice* Wiley

8.254
Civil Engineering Materials — SS L3T1

Prerequisite: 8.252.

Part I—Concrete: mechanical properties. Multi-phase theory of elastic behaviour, effect on deflection of structural members. Bond with reinforcement. Volume change. Special requirements in design and construction methods. Durability. Permeability, extensibility and crack resistance. Thermal effects, residual stresses. Physical and chemical deterioration. Concrete manufacture, field control and acceptance.

Laboratory. Examination of concrete and concrete materials; aggregate testing, mix design, mechanical properties of concrete.
Part II—Soil Engineering.
Foundation engineering; bearing capacity theory; allowable settlement, shallow and deep foundations; rafts; pile groups; site investigation as applicable to foundation design. Earth and rockfill dams, types, materials, stability analysis and design, construction problems.

Laboratory. Consolidation and shear strength testing of cohesive and granular soils. Evaluation of simple earth pressure, foundation engineering and earth dam theory.

Textbooks

As for 8.253.

8.259
Properties of Materisls — S1 + S2 L1T2

8.250 Properties of Materials, *plus* the structure and properties of binary alloys; control of structure and properties, commercial alloys, materials selection.

Textbooks

As for 8.250.

8.271
Introduction to Materials

This subject forms part of 5.010 Engineering A and 5.030 Engineering C.

As for 5.010 Engineering A and 5.030 Engineering C.

8.272 — S1 + S2 L1½T2½
Civil Engineering Materialsl

Prerequisites: 5.010, 5.020, 5.030

Crystal Structures, planes and directions. Lattice defects. Grain structure of metals. Mechanical processing and heat treatment of metals and alloys. Interpretation of mechanical properties of metals on the basis of structure. Ferrous and non-ferrous alloys. Welding processes and welding metallurgy. Non Destructive Testing. Welding distortion and residual stresses. Structure and chemistry of polymers. Mechanical properties of plastics. Structure of silicates. Clays. Chemistry of cements. Geotechtonics and structural geology. Mapping and geological investigation.

8.273 — S1 + S2 L1½T1½
Civil Engineering Materials II

Prerequisites: 8.172, 8.272.

Basic soil properties. Site investigations. Failure criterion. Stability of soil structures. Foundations and retaining structures. Steady and transient flow of water in soils. Consolidation. Stabilization. Stability of slopes. Earth and rockful dams. Dynamically loaded soil structures. Case studies.

Equilibrium and compatibility equations. Linear elastic model. Failure theories. Failure of brittle and ductile materials; Strength properties and allowable stresses for materials subjected to static and variable stresses. Safety. Mechanics of fracture, fracture toughness and its significance.

Textbooks

Terzaghi K. V. & Peck R. B. *Soil Mechanics in Engineering Practice* Wiley Int Ed
Ingles O. G. & Metcalf J. *Soil Stabilization* Butterworths
Mase G. E. *Continuum Mechanics* Schaum
Polakowski N. H. & Ripling E. J. *Strength and Structure of Engineering Materials* Prentice-Hall
or
McClintock F. A. & Argon S. eds *Mechanical Behaviour of Materials* Addison-Wesley

8.274 — S1 + S2 L1½T1½
Civil Engineering Materials II

Prerequisite: 8.273.

Structural fatigue. Fracture safe design. Specification of metallic materials. Corrosion and corrosion protection. Modern steels. Structural aluminium alloys, properties, selection, applications and limitations. Evaluation of timber properties in structural design.

Properties of concrete. Structure and composition. Phiological models of fresh concrete. Misc. Design. Multi-phase theory of elastic behaviour. Bond with reinforcement. Creep and drying shrinkage. Durability, physical and chemical deterioration, permeability. Non-destructive testing.

Textbook

Neville A. M. *Properties of Concrete* Pitman

8.301
Systems Engineering — SS L2T2

The systems approach to engineering problem formulation, modelling, and decision analysis is presented in a project format. Relevant system modelling concepts, techniques, and decision models are introduced during project development.

Textbook

Meredith D. D. Wong K. W. Woodhead R. W. & Wortman R. H. *Design & Planning of Engineering Systems* Prentice-Hall

8.351
Engineering Mathematics — SS L2½T2½

As for 8.161 Engineering Mathematics.

8.531
Water Engineering — S1 + S2 L2½T1½

Hydrology—The hydrologic cycle, the runoff cycle, water balance, energy balance, circulation of atmosphere, dynamic cooling, condensation and precipitation, probability analysis of precipitation and floods, infiltration, soil water and groundwater hydrology, steam-gauging, hydrograph analysis, flood estimation, yield and storage determination, evaporation, evapo-transpiration.

Hydraulics—Dimensional analysis, hydraulic model theory, scale effect. Fluid turbulence, velocity distribution, surface resistance in flow plast plane boundaries and in pipes and channels. Pipe flow, pipe networks, water-hammer. Channel flow, steady non-uniform flow, backwater curves, hydraulic jump, unsteady flow, waves, flood routing. Flow measurement. Hydraulic machinery, radial and axial flow, characteristic curves, cavitation.

Public Health Engineering—Elements of organic chemistry, elements of biology, process of decomposition and decay, colloids and colloidal solutions, adsorption, ionic theory and dissociation, chemical and biochemical measurement of degree of pollution, rate of biochemical oxidation, principles of water treatment, principles of sewage treatment.

Textbooks

Giles R. V. *Fluid Mechanics and Hydraulics* Schaum's Outline Series Schaum NY
Nemec J. *Engineering Hydrology* McGraw-Hill
Tebbutt T. H. Y. *Principles of Water Quality Control* Pergamon
Vennard J. K. *Elementary Fluid Mechanics* 4th ed Wiley

8.532
Water Engineering — S1 + S2 L1½T1½

Part I—Hydraulics: Unsteady Flow: pendulation and surge tank, water hammer in branching lines, waves in frictionless channels, solitary, preiodic and shallow water waves, surges and flood waves, flood waves, flood routing. *Sediment Theory:* introduction to critical tractive stress and regime theories, design of stable channels in alluvium. *Hydrodynamics:* equations of continuity, motion and vorticity ϕ and ψ functions, Laplace equation, standard flow patterns, introduction to method of solution of Laplace equation. Applications to groundwater hydraulics. *Advanced Hydraulics Computations:* solution to selected hydraulic problems including backwater calculations, unsteady flow with friction, pipe networks, surge tanks, water hammer, two-dimensional networks.

Part II—Applied Water Engineering: water resources problems and solutions, the systems approach. General principles of regulation and utilisation of water; reservoirs and storage, distribution and transmission, treatment, collection and disposal. Examples of applied water engineering selected from the following fields: water supply, sewerage, irrigation, land drainage, urban drainage, flood control, hydro-electric generation, multi-purpose projects, river channel control, coastal engineering.

Textbook

Vennard J. K. *Elementary Fluid Mechanics* 4th ed Wiley

8.571
Hydraulics I — S2 L1½T1½

Fluid properties: hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations.

Textbooks

Giles R. V. *Fluid Mechanics and Hydraulics* Schaum's Outline Series Schaum NY
Vennard J. K. *Elementary Fluid Mechanics* 4th ed Wiley

8.572
Hydraulics II — SS L1½T1½

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.

Textbooks

As for 8.571.

8.573
Hydraulics III — SS L1½T1½

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.

Textbooks

As for 8.571.

8.581
Water Resources I — SS L1½T1½

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.

Textbook

Tebbutt T. H. Y. *Principles of Water Quality Control* Pergamon

8.582
Water Resources II — SS L1½T1½

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

8.583
Water Resources III — SS L1T2

Hydraulics of groundwater systems, application to regional problems. Water resources planning, systems approach, applied aspects of water engineering.

8.631
Civil Engineering — S1 + S2 L3T½

Part I: Regional and Urban Planning. The planning process with particular regard for the improvement of urban environment. The unified approach and the role of the civil engineer. Socio-economic and physical elements. Historical background to the urbanisation process. Regional planning: principles of regionalism, regional survey techniques, case studies. Urban planning: urban form and growth patterns, communication networks. Principles of site planning and civic design. Outline of town planning law and administration in New South Wales.

Part II: Transport Planning and Operations. Definition of a land use/transport system—land use potential, traffic generation, intensity of traffic generation, transport system capacity. Stability and steady state performance—output, specific output. Land use, generation, desire line and assignment models. The transport planning process—systems versus programming approach. Evaluation of operational performance of transport systems—travel time and flow relation-

ships (the queueing model), level of service, network characteristics, transfer terminals. Economic evaluation of transport schemes and plans—criteria, benefits, costs, time streams, discounting, present worth, rates of return, benefit/cost and cost/effectiveness ratios.

Part III: Road Engineering. Route analysis and road location in the rural and urban environment including the location of bridges. Road geometrics and design, its influence on the behaviour of drivers. Landscape aspects of road design. Some examples of road design policies and their application. Types of roads and expressways and their applications, advantages and disadvantages. Types of intersections and interchanges,and some problems in their design. Pavement requirements, thickness design, pavement materials, gravels, stabilisation, cement and bituminous concrete. Function of wearing courses. Road drainage requirements and examples of design, road construction methods and plant. Uses of electronic computation in Highway Engineering.

Part IV: Project Planning and Evaluation. Management principles: historical development; scientific management; the managerial process, communication and control. Management practice: the role of design, research and development; management functions. Organisation: span control divisionalisation, responsibility, authority and accountability. Engineering economics: interest, rates of return, minimum attractive rate of return, comparison, benefit-cost ratio. Project planning: organisational pattern, cost control, procurement, personnel management, resources scheduling and planning, critical path, project evaluation and review. Project evaluation: cost estimation, benefit estimation, economic comparison.

8.632
Civil Engineering

Comprises Parts I and III, being respectively Regional and Urban Planning and Road Engineering of 8.631 Civil Engineering.

8.670 SS L2T1
Introduction to Engineering Construction

This subject forms part of 5.030 Engineering Construction. Introduction to construction engineering, projects and decision agents, construction equipment and methods. Compulsory field excursion to a civil engineer construction site.

Preliminary Reading List

Antill J. M. & Ryan P. W. S. *Civil Engineering Construction* 4th ed A & R
Pannell J. P. M. *An Illustrated History of Civil Engineering* Wiley
Peurifoy R. L. *Construction Planning Equipment and Methods* 2nd ed McGraw-Hill

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. The analysis, estimating, design, field prediction models, field operation and control of construction operations. State of practice in engineering construction.

Textbook

To be advised.

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.

Textbooks

Antill J. M. & Ryan P. W. S. *Civil engineering Construction* 4th ed A & R
Antill J. M. & Woodhead R. *Critical Path Methods in Construction Practice* McGraw-Hill
Standards Association of Australia *General Conditions of Contract* CA 24.1
O'Neill L. V. *Fundamentals of Estimating and Cost Control* Tait

8.673
Planning and Management II SS L1T2

Prerequisite: 8.672.

Types of engineering projects, the feasible, risk, financial and economic analysis of projects at the plant engineer, contractor, shire engineer, entrepeneur, government agency and national decision levels.

Textbooks

Investment Analysis, Supplement to the Treasury Information Bulletin (White Paper), Commonwealth Treasury, Canberra, July 1966
Grant E. L. & Ireson W. G. *Principles of Engineering Economy* Ronald Press

8.674
Planning and Management III SS L1T2

Prerequisite: 8.001, 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 relationships 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.

Textbook

Vennard J. K. *Elementary Fluid Mechanics* 4th ed Wiley

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.

Textbooks

Lambe T. W. & Whitman R. V. *Soil Mechanics* Wiley
Leeper G. W. *Introduction to Soil Sciences* M.U.P.

8.713
Management for Surveyors SS L2T0

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

Graduate Study

8.701G
Decision Making in Civil Engineering

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

8.702G
Network Methods in Civil Engineering

Graphs, flow-in networks, optimal paths, critical path schedule, resource levelling, simulation networks, stochastic netowrks, project management, further applications.

8.703G
Optimization Techniques in Civil Engineering

Search, linear programming, non-linear programming, dynamic linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.704G
Stochastic Methods in Civil Engineering

Queueing, Markov processes, theory of storage, reliability, renewal, application, transportation and allocation.

8.705G
System Modelling

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 to be limited to selected students.

8.706G
Experimental Methods in Engineering Research

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.

8.708G
Finite-Element Methods in Civil Engineering I

The concept of finite elements. Energy principles. Finite elements of displacement type. Computer techniques for finite elements.

8.709G
Finite Element Methods in Civil Engineering II

Finite elements of equilibrium type. Hybrid elements. Constitutive relations. Application of finite elements in various fields of civil engineering.

8.710G
Advanced Topics in Optimization in Civil Engineering

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

Special studies in system modelling to be offered from time to time by appropriate specialists.

8.723G
Construction Design

Design of field services and structures; compressed air services, coffer-dams, ground anchors, floating plant, formwork and false-work, bridge centring, well-points and dewatering systems.

8.724G
Construction Technology

Blasting techniques, tunnelling, rock-bolting and other ground support, harbours, railways, dams, bridges, structural steelwork techniques, pipeline construction, foundation grouting, pile-driving, compressed air work.

8.725G
Construction Accounting and Control

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

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

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

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.

8.753G
Soil Mechanics I

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

8.754G
Soil Mechanics II

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

8.755G
Materials of Construction I

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

8.756G
Materials of Construction II

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

8.759G
Rock Mechanics

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

8.761G
Advanced Rock Mechanics

Finite element analysis and application to open and underground excavations, stability of rock slopes, design of underground openings, rock anchors, grouting, blasting—theory and techniques. Tunnelling techniques, weathering.

8.763G
Rock Mechanics Investigations

Elastic solutions applicable to flat jack and over-coring methods for measurement of field stress state and to field measurement of deformation. Laboratory projects. Measurement of strength and deformation characteristics of rock. Direct shear tests on joints. In-situ stress measurements by flat jack and over-coring. Plate bearing test. Joint survey. Field trip of approximately two weeks' duration.

8.764G
Composites in Civil Engineering

Physical and mechanical properties of composites.

8.766G
Welding In Structural Engineering

Terminology, welding processes, metallurgy, weldability of ferrous and non-ferrous metals, pre-heat and post-heat treatments, residual stresses.

8.768G
Fracture Mechanics

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

8.771G
Foundation Engineering

A specialized study of theoretical and practical aspects of geotechnical engineering directly relevant to the analysis and design of foundation systems. The primary object of the course is to establish the state-of-art with particular emphasis on the application of recent theoretical developments to foundation engineering, including piles, rafts, raft-piles, laterally loaded piles, retaining structures and techniques of strengthening soils.

8.802G
Elastic Stability I

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

Energy methods of formulation of stability problems. Approximate methods. Thin-walled open section struts; lateral buckling of beams; bending and buckling of thin plates.

8.804G
Vibration of Structures I

Review of basic aspects. Analysis of lumped mass systems with various degrees of freedom. Vibration in beams and other continuous structures.

8.805G
Vibration of Structures II

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

Historical development. Methods of prestressing. Elastic analysis and design. Flexural capacity and shear capacity of prestressed elements.

8.807G
Prestressed Concrete II

Analysis and design of statically indeterminate structures. Methods of securing continuity. Composite structures.

8.808G
Prestressed Concrete III

Analysis and design of various prestressed concrete structures. Estimating and costing.

8.809G
Reinforced Concrete I

Historical development. Methods of analysis and design, including limit state concepts. Analysis and design for bending, compression and combined bending and compression. Serviceability requirements.

8.810G
Reinforced Concrete II

Creep and shrinkage effects in concrete structures. Application of limit theorems to structural concrete. Lower bound methods of design. Analysis and design of plates and slabs.

8.811G
Reinforced Concrete III

Composite construction. Plastic design. Fatigue and vibration. Analysis and design of multi-storey buildings. Optimal design of reinforced concrete structures.

8.812G
Plastic analysis and design of Steel Structures I

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

Estimation of deflections; factors affecting plastic moment; shakedown; three-dimensional plastic behaviour; minimum weight design.

8.814G
Analysis of Plates and Shells

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.

8.815G
Computer Analysis of Frames I

Matrix methods of analysis. Flexibility analysis and stiffness analysis. Axis transformation. Shear walls. Computer applications.

8.816G
Computer Analysis of Frames II

Computer solution of three-dimensional frames, including buildings with in-plane rigid floors. Elements of matrix solution of dynamic and elastic stability problems. Numerical techniques for large structural systems.

8.817G
Experimental Structural Analysis I

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

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

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.

8.830G
Hydromechanics

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

Theories for energy loss in conduit flows, roughness at pipe walls and tunnels, design applications. Cavitation in conduits, transport of water borne mixtures in pipes, accuracy of flow measurements in pipe lines.

8.832G
Pipe Networks and Transients

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

Theory of water flow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transistions. Use of hydraulic models.

8.834G
River and Estuarine Hydraulics

Channel flow in natural and urban channels, tidal and flood flows, loose bed and earthen bank stability, sediment transport, interfaces, diffusion and mixing processes, hydraulic models for river works.

8.835G
Coastal engineering I

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

Wave forces on structures, shore processes and beach erosion. Estuarine hydraulics, wave and tide models.

8.837G
Hydrological Processes

Hydrologic cycle, atmospheric moisture, precipitation process, precipitation analysis, evaporation and transpiration, storm runoff process, interception, infiltration curves, land use and management, instruments.

8.838G
Hydrological Design

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

8.839G
Advanced Methods of Flood Estimation

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

8.840G
Hydrological Models and Data Synthesis

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

8.841G
Hydrometeorology

Water and energy balances, atmospheric moisture, precipitation, evaporation and transpiration, snow and snowmelt, extreme precipitation.

8.842G
Groundwater Hydrology

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

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

Hydrologic characteristics of unsaturated media, hysteresis, theory of infiltration, drainage and redistribution studies, laboratory and field instrumentation, applications to field problems.

8.845G
Investigation of Groundwater Resources

Evaluation and development of groundwater resources, seismic and resistivity methods, well-logging techniques, drilling methods, management of groundwater resources, conjunctive use studies.

8.847G
Water Resources Policy

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

8.848G
Water Resources System Design

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

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

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

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

Water collection, transmission, and distribution systems—layout design and analysis, reservoirs, pumping. Sewage collection system design and analysis—capacities, corrosion, pumping.

8.853G
Public Health Science

Science in public health engineering; environmental factors. Applications of chemistry, physics, biology, and biochemistry to water and wastewater technology. Control of disease and industrial hygiene; community health and epidemiology. Food technology. Air pollution and solid wastes. Radioactivity and radioactive wastes.

8.855G
Water and Wastewater Analysis and Quality Requirements

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

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

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

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.

8.901G
Civil Engineering Elective I

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

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

8.918G
Research Project

Department of Industrial Engineering

Undergraduate Study

18.011
Industrial Engineering IA S1 + S2 L1¼T¾

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

Manufacturing Properties of Materials: Stress-strain curves to high strains, effects of strain-rate and temperature. Properties under hot and cold working. Combined stresses, yield criteria, introduction to plasticity theory. Friction effects in metal working, plane strain forging and rolling. *Metal Cutting Theory:* Mechanics of the process, effect of work-hardening, prediction of shear angle and cutting force. *Metal Cutting Tools:* Tool materials: plain carbon, alloy steel and sintered materials, hardening and heat treatment, T.T.T. curves. Tool wear, life and failure, tool performance. Surface finish. Machinability. Economics of machining. *Other Metal Removal Processes:* Electric-discharge machining, electrochemical machining.

Textbook

Radford J. D. Richardson D. B. *Production Engineering Technology* Macmillan

18.012
Industrial Engineering IIA S1 + S2 L2T1

Prerequisites: 5.112, 18.011.

Theory of Manufacturing Processes: Processes including extrusion, tube making, rolling, blanking and piercing, sheet metal framing 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.

Textbook

Radford J. D. & Richardson D. B. *Production Engineering Technology* Macmillan

18.021
Industrial Engineering IB S1 + S2 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.

Textbooks

Burr I. W. *Engineering Statistics and Quality Control* McGraw-Hill
Smith G. W. *Engineering Economy* Iowa State UP 1973

18.022
Industrial Engineering IIB S1 + S2 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 techniques in quality control. Control charts. Further quantitative work.

18.121
Production Management S1 + S2 L3T0

Prerequisites: 10.031, 10.331.

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

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

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

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

Textbooks

Buffa E. S. *Modern Production Management* 4th ed Wiley
Lu F. P. S. *Economic Decision-making for Engineers and Managers* Whitcomb & Tombs
Moore P. G. *Basic Operational Research* Pitman

18.431
Design for Production S1 + S2 L2T4

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 toleranc-ing; interpretation, datum systems, analysis, standard presentation, grouping. Economics of tolerance allocation. Process capability; relationship between process capabilities and product requirements. Jig, fixture and gauge design; production datum systems and their relation to function datum systems, effect of jig, fixture and gauge tolerances on product function. Metrology; measurement of size, form and position, design of measuring systems, measurement errors, theory of inspection.

Textbooks

Gladman C. A. *Geometric Analysis of Engineering Designs* Aust Trade Pub
Radford J. D. & Richardson D. B. *Production Engineering Technology* Macmillan

18.432 S1 + S2 L2T4 (Project)
Design of Production Systems

Prerequisites: 5.071, 18.011, 18.021. Co- or prerequisite: 18.012.

This subject may be taken only by potential graduates.

Interchangeable Manufacture: Design for production, tooling gauges, metrology.

Process Selection: Evaluation of alternative processes, make or buy decisions, planning the process sequence, case studies.

Production Planning: Forecasts, capacity decisions, plant location, factory design and layout.

Production Systems: Computer systems for production control and information flow, computer control of machines and groups of machines, socio-technical systems.

Project: The project will consist of the design analysis for production and the planning of the production system for the manufacture of a simple engineering assembly. A comprehensive written report will be required.

Textbooks

Gladman C. A. *Geometric Analysis of Engineering Designs* Aust Trade Pub
Radford J. D. & Richardson D. B. *Production Engineering Technology* Macmillan

18.551
Operations Research S1 + S2 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, e.g. production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

Textbook

Taha H. A. *Operations Research: An Introduction* Macmillan

Graduate Study

18.061G
Industrial Experimentation I

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

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

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.

18.081G
Industrial Engineering I

Organization and Administration: The development of the theory and practice of organization in industry. The nature and types of organization. The application of the principles of organization in the design of organizational structures. *Design of Manufacturing Facilities:* Product and objectives, equipment selection. Charting and systematic improvement of methods, factory and workplace layout. *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. *Production Control:* The detailed mechanics of control of production. Manufacturing organizations, functions, inter-relationships and information flow. Application of data processing and control systems. Introductory inventory control. *Industrial Psychology:* Motivation to work, frustration and conflict, social aspects of industry, worker participation.

18.082G
Industrial Engineering II

Analysis of Decisions under Uncertainty: The structure of decision problems; payoff matrices, decision trees. Utility of risky choice. Bayesian decision rules and their applications. *Ergonomics:* Kinesiology. Work and effort. Climatic factors. Dimensions of workplace layout. Job design. Selection and use of machine controls. Management of individual differences. Personnel selection. Psychological factors in industry. *Industrial Studies:* Studies in organizational and executive action requirements of specific industrial situations, using the case study method. *Operations Research:* The formulation and optimization of mathematical models. The development of decision rules. The application of operations research methods to industrial situations.

18.171G
Inspection and Quality Control

Economics of measurement; advanced measuring and inspection methods; non destructive testing; quality control systems; sampling by attributes and variables; standardization; case studies; process capability and variability; machine tools acceptance testing; alignment procedures.

18.271G
Theory of Machining and Forming Processes

Plasticity theory: Approximate methods of solution including upper bound; slip line field theory. *Manufacturing properties of materials:* Influence of strain, strain rate and temperature on flow stress. *Analysis of forming processes:* Application of theoretical methods; solutions for ideal and work hardening materials. *Analysis of machining processes:* Orthogonal and oblique machining theories; application to drills and multi-point tools; prediction of cutting forces, temperature, stresses.

18.272G
Technology of Machining and Forming Processes

Selected topics from: Machine tool vibration; design of machine tool elements; economics of machining and forming; numerical and adaptive control of machine tools; design of dies and cutting tools for strength and wear resistance; automation.

18.371G
Factory Design and Layout

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.

18.461G
Design for Production

Influence of manufacturing processes on design; design simplification and standardization; value engineering; economics of process selection; case studies.

18.462G
Industrial Design

Economic considerations; fundamentals of design; influence of processes; case studies.

18.463G
Tool Design

Advanced theories and techniques for design and specification of cutting tools; jig and fixture design; press tool design, gauge design; design of selected machine tool components; computer aided tool design.

18.471G
Design Communication

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

18.472G
Engineering Design Analysis

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

18.571G
Operations Research I

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 will be applied to situations drawn from industrial fields, for example, production planning and control. Practical problems of data collection, problem formulation and analysis will be included.

18.574G
Operations Research II

Problem definition. Principles of model building. Participation in an operational simulation. Construction of decision rules. Operations Research case studies and seminars.

18.671G
Decision Theory

Theories of choice, value, risk and uncertainty for the individual and for multi-person situations. Statistical decision theory, Bayes and minimax rules.

18.681G
Engineering Economic Analysis

Price-output decision under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their application in the selection and replacement of processes and equipment. Construction and optimization of particular models, e.g. replacement, capital rationing. Measures of profitability.

18.761G
Simulation in Operations Research

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.

18.770G
Stochastic Control

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

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

Brief survey of dnyamic 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

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

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

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 (e.g. 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 and Forecasting

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

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

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.

18.871G
Mathematics for Operations Research

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.

18.872G
Mathematical Programming A

Advanced topics in linear programming. Simplex based non-linear programming. Integer programming. Zero-one programming. Applications of mathematical programming. Mathematical programming lanugages.

18.873G
Mathematical Programming B

The scope of the general non-linear programming problem. Multivariable search techniques for unconstrained and constrained problems. Penalty function techniques. Introduction to Geometric Programming. Applications to Operations Research problems.

18.874G
Dynamic Programming

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

The geometric programming theory is developed for convex and non-convex mathematic 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

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

Overview of large-scale problem. Identification of the master problem and subproblem. Structure of the problem: coupling variables, coupling restraints; block diagonal, block triangular matrices. Solution strategies.

18.909G
Project

18.918G
Research Project

18.936G
Research Project

18.960G
Seminar (Production Engineering)

18.967G
Advanced Topic in Production Engineering*

18.968G
Advanced Topic in Production Engineering*

18.969G
Advanced Topic in Production Engineering*

18.970G
Seminar (Operations Research)

18.977G
Advanced Topic in Operations Research*

18.978G
Advanced Topic in Operations Research*

18.979G
Advanced Topic in Operations Research*

18.981G
Industrial Computations

Probability and Statistics: An introduction to probability theory. Random variables and distribution functions. The Binomial, Poisson and Normal distributions in particular. Standard sampling distributions, including χ^2, t and F. Estimation by moments and maximum likelihood. Confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data.

Industrial Applications of Probability: Tutorial problems from the fields of sampling inspection, quality control, control charts. Simple economic models—for example, the newsboy problem, length of steel bars.

Digital Computer Programming: The basic elements of computer programming. A number of programming assignments will be included.

School of Transportation and Traffic

Graduate Study

19.101G
Applications and Practice of Traffic Engineering

1. Vehicle and driver characteristics; 2. measurement of traffic; 3. the design and execution of traffic surveys; 4. kinematic design of highways: capacity, lanes, medians, shoulders; 5. intersection design and control; 6. traffic control devices and regulations: unbalanced flow, speed limits and zoning, pedestrian control; 7. street lighting: methods of discernment, characteristics of lighting systems, location and spacing; 8. organization of traffic engineering functions; and 9. traffic law and enforcement.

19.111G
Theory of Traffic Behaviour

Congestion theory. Car-following theory. Kinematic waves. Headway and speed distributions. Traffic counting distributions. Speed-flow concentration relationships. Traffic signals and signal systems. Unsignalized conflicts. Simulation.

19.121G
Theory and Practice of Statistics for Traffic Engineers

Probability. Variates (univariates, multivariates, expectations, moment generating functions). Standard distributions. Sampling distributions. Point estimation. Confidence intervals. Test of significance. Regression (including multiple regression). Elementary analysis of variance and experimental design. Introduction to sampling techniques. Probability theory (application of Laplace transform to renewal processes, topics in queueing theory).

19.131G
Land Use and Transport Planning

The development of the basic laws of land used and transport system interaction. Covers models for traffic generation, desire line distribution and inter- and intramodal assignment. The systems and programming philosophies of transport planning. Mathematical programming.

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

19.141G
Transport Systems Analysis

Historical introduction to sea and land transport systems. The impact of the internal combusion engine and subsequent rise of automobile and air transport. Description and methods of measurement of performance characteristics of different transport modes: rail, road, sea, air, pipeline, e.g. capacity, speed range, unit operating costs. Operating characteristics of terminal and transfer facilities. Frequency and speed of service, timetables, peak hour problems. Cargo and passenger systems, description of cargo characteristics. Inventory, insurance and packaging costs. Development of criteria for distribution and assignment of cargo and passenger traffic.

19.151G
Economics of Transport

Introductory economics and economic theory. Elements of theory of value and allocation, theory of employment. National income and social accounting. The pricing mechanism in transport and distinctive characteristics of transport demand and costs. Economics of public enterprise; economic policy and practices in transport; road, rail, air and sea. Costs and benefits of transport investment, theory of the location of households and workplaces, criteria for public investment in urban and regional areas. Selected special problems in the economics of transport.

19.161G
Characteristics of Transport Systems

Historical introduction to sea and land transport systems. Description and methods of measurement of performance characteristics of different transport modes: rail, road, sea, air, pipeline, e.g. capacity, speed range, unit operation costs. Operating characteristics of terminal and transfer facilities. Cargo and passenger systems, description of cargo characteristics. Inventory, insurance and packaging costs. Criteria for distribution and assignment of cargo and passenger traffic.

19.171G
Fundamentals of Transport Economics

Introductory economics and economic theory. The pricing mechanism in transport and the distinctive characteristics of transport demand and costs. Economic policy and practices in transport: road, rail, air, sea. Public enterprise economics. Costs and benefits of public investments in transport. Investment criteria. Selected special problems in the economics of transport.

19.181G
Introduction to Statistics

Introduction to probability theory. Random variables and distribution functions: binomial, normal and Poisson. Standard sampling distributions: χ^2, t and F. Estimation of confidence intervals. Tests for significance based on above distributions. Introduction to linear regression and least squares adjustment of data.

19.191G
Introduction to Traffic Theory

Introduction to queueing and congestion theory. Demand and service characteristics. Maintenance and inventory theory. Scheduling and timetabling. Introduction to computer programming and simulation. Traffic patterns. Traffic flow and control: road, rail, air, sea. Traffic capacity: flow-velocity-density relationships.

19.211G
Fundamentals of Transport Planning

The main topics covered are: Generation of traffic, estimation of traffic growth and assignment of traffic to competing travel modes. Land use and transport interaction.

19.221G
Traffic Operation and Control

Traffic measurements and data handling. Studies of capacity of roads and intersections, levels of service, delay. Accident analysis and treatments. Traffic service—street lighting and guidance. Principles of traffic design, improvements.

19.909G
Project

19.918G
Research Project

19.936G
Research Project

School of Highway Engineering

Graduate Study

20.002G
Soil Mechanics Applied to Road Engineering

Nature and origins of soil. Site investigation, sampling and in-situ testing techniques. Soil Classification and its engineering significance. Failure criteria for soils. Stress-strain properties of soils. Consolidation and settlement, improvement of weak soils. Bearing capacity. Movement of water in saturated and unsaturated soils. Design of embankments, slopes and cuttings. Design of earth retaining structures. Foundations for highway structures.

Compaction and soil stabilization. Material specifications. Soil water potential under covered areas. Climatic and topographical factors. Traffic factors. Distribution of wheel loads in layered systems. Response of pavement materials to traffic loading. Design methods for flexible and rigid pavements and overlays for highways and airfields. Evaluation of pavement serviceability.

20.003G
Road Engineering Practice

Bituminous Construction: Standard tests for bitumens and tars. Theoretical design of bituminous concrete mixes. The importance of air voids and analysis of constituents of bituminous concrete. Grading of aggregates. Tests for road aggregates. Method of bituminous mix design. The Hubbard Field method of bituminous mix design. The Hveem method of bituminous mix design. Difficulties inherent in stability testing. Determination of the proportions of the constituents of a sample of bituminous road material. The forms of road bitumens. Straight run bitumens. Cutback bitumens. Bituminous emulsions. Open textured bituminous macadam. Dense mix. Surface dressing. The weathering of bitumen.

Highway Law: Highway law, the law of contracts, definition of a contract, five necessary elements for a valid contract. Operation and interpretation, fundamental principles and established practice, time for performance, discharge or dissolution, remedies for breach of contract, variations. Powers and duties of the engineer, agency, commercial arbitration, approvals, scope of obligations and authority, both legal and ethical, related constracts, carriage of goods by land, insurance, master and servant (contracts of employment), sale of goods, arbitration act.

Contract Documents: Engineering contracts, types of contract, contract documents, general conditions of contract, drawings, specification, schedule or Bill of Quantities, tenders, letter of acceptance, the agreement, mechanics of execution of a contract, contract law in other countries. Specifications, purpose and relationship to other contract documents, principles of specification writing, basic layout, method of approach and composition, bills of quantities, purpose and relationship to other contract documents, methods of presentation, principles of preparation and standard procedures, units.

Critical Path Planning and Use of Computers in Highway Engineering: Need for construction planning. Introduction to Operations Research. The Critical Path Method, P.E.R.T. Use of C.P.M. and P.E.R.T. in planning, control and supervision. Problem oriented computer languages for C.P.M. and P.R.T. (ICES-PROJECT). Introduction to computers and programming.

Aggregates: Types of aggregates, properties of aggregates, review of available tests, difficulties of testing, relationship between results of arbitrary and fundamental tests, effect of various factors on the result obtained with Los Angeles and aggregate crushing tests, importance and determination of surface texture of aggregate, curshing and preparation of aggregate and factors affecting particle shape, importance of free silica content in crushing, presence of secondary minerals and other factors affecting durability, alkali aggregate reaction, proportioning (blending) aggregates.

Quarrying and Plant Selection: Acquisition and administration of plant. Estimating plant productivity. Estimating plant cost. Quarrying, crushing and screening.

20.041G
Road Location and Design—Part I

Preliminary and final survey, geometric designs of roads for rural and urban conditions, sight distances, stopping distances, passing distances, road gradients, super-elevation horizontal curves, vertical curves, appreciation of visual effects of combinations of horizontal and vertical curves, design models, types of cross section, speed change lanes, median lanes, median openings, design of at grade road junctions, expressways and parkways, types of and design of grade separation crossings. Road planning, design traffic load estimation, urban highway network planning and design road capacity and levels of service. Drawing office examples in design for rural and urban conditions.

20.042G
Road Location and Design—Part II

Traffic Engineering: Traffic measurements, relation between flow and concentration, speed, sampling, headway distributions and gap acceptance, delays to conflicting streams, car following behaviour, traffic signals (isolated and linked), street lighting, accident studies and traffic control warrants.

Photogrammetry: Drawing office methods of photo measurement and interpretation, radial line plotting, parallax bar measurements, controlled mosaic assembly.

Town Planning and Landscape Architecture: Analysis of the 20th century town, principles of land use zoning, planning for traffic and transport, public open spaces, the planning of residential areas, planning for industry, visual quality of urban and rural environment, the city centre, vegetation and environment, plant materials, principles of landscape design, examples of landscape design, street and roadside planting, urban sociology.

Hydrology: Urban drainage design, hydraulic design of highway structures, introduction to run off process and estimates, review of and discussion of the theoretical basis for the most important existing methods of calculating culvert and gully sizes.

20.052G
Road Location and Design—Part II (Surveyors)

As for 20.042G, omitting section on Photogrammetry and adding: *Use of computers in Highway Engineering:* capabilities and limitation of integrated design systems used in highway design.

20.061G
Road Location and Design—Part I

As for 20.041G.

20.062G
Road Location and Design—Part II

As for 20.042G.

20.121G
Soil Analysis, Pavement and Bridge Foundation Design—Part I

Strength and deformation properties of saturated and unsaturated soils, application of theories of plasticity in stability analysis, treatment of weak grounds marshes, etc., sand drains, investigation design and field observations of stability of natural slopes cuttings and embankments, earth pressures relative to abutments and wing walls, design and construction of shallow and deep bridge foundations, factors of safety, use of piles and caissons, grouting techniques, settlement prediction and measurement, subsoil exploration, engineering geology, ground water lowering, subsoil drainage.

20.122G
Soil Analysis, Pavement and Bridge Foundation Design—Part II

Soil classification, function and material specifications of pavement base (base course), moisture under steady and non-steady conditions and under temperature gradients, moisture equilibrium, soil suction, frost heave, laboratory and field methods of soil compaction, soil structure, field control of compaction, performance of compaction plant, stage compaction, area compaction proof rolling, cement, lime, bituminous and mechanical stabilization, environmental factors, stress distribution in layered systems, dynamic behaviour of soil and flexible pavement structures, design criteria for flexible pavements, critical review of some current design methods, modern trends, airfield runways pavement design, review of pavement evaluation by surface deflection AASHO road test and other methods, design of overlays, evaluation of subgrade reaction, analysis of temperature stress in concrete slabs, design of rigid pavement analytical and empirical methods.

20.131G
Road Construction—Part II (Surveyors)

Soil Engineering for Highways: The origin and formation of soils, soil as an engineering material, classification of soils, site investigation, sampling and in situ testing, stress-strain and consolidation characteristics of soils, failure hypotheses, laboratory test methods, moisture movement in saturated and unsaturated soils, soil suction, compaction characteristics of soils, field and laboratory compaction, specifications for compaction, the role of soil structure, the effects of temperature and other environmental factors, the improvement of soil properties by mechanical stabilization or by the use of binders or additives.

Pavement design methods for flexible and rigid pavements, stability analysis and field observation of natural slopes, cuttings and embankments, earth pressure relative to abutments and wing walls, reinforced earth, sand drains, ground water lowering, applications of computers in soil engineering.

20.211G
Road Construction—Part I

Materials Science: Rheology, study of linear and non-linear materials, mechanistic and phenomenological approaches, time and temperature dependent processes, state process theory, viscoelasticity and elasticity, multiphase materials, mathematical models for material behaviour, three dimensional analyses of stress and strain, failure mechanisms in continuous and particulate materials, choice of testing methods and their influence on results, blending materials, wave propagation methods and their interpretation, factors affecting road surface friction at high and low speeds, measurement of road surface friction.

Bituminous Materials: Forms and origins of binders, emulsions selection criteria, laboratory tests, physical and chemical properties of binders, design of dense and open graded bituminous mixes, stability tests, engineering properties of mixes, continuous and batch manufacture of mixes, construction of bituminous concrete surface courses and full depth pavements, overlays, special forms of bituminous construction, heavy duty surfacings, seal coats, primes and primeseals, durability of bituminous materials, stripping, climatic factors, maintenance procedures, comparisons of Australian and overseas practice.

Aggregates: Types of aggregates, properties of aggregates, review of available tests, difficulties of testing, relationship between results of arbitrary and fundamental tests, effect of various factors on the result obtained with Los Angeles and aggregate crushing tests, importance and determination of surface texture of aggregate, crushing and preparation of aggregate and factors affecting particle shape, importance of free silica content in crushing, presence of secondary minerals and other factors affecting durability, alkali aggregate reaction, proportioning (blending) aggregates.

Geology: Geophysical methods of investigating foundations conditions of proposed bridge sites, roads or other engineering constructions. The seismic refraction methods and specialized techniques for the detailed investigation of the depth and quality of subsurface rock and overburden. Electrical resistivity methods and their use in foundation investigation, finding overburden thickness, or related problems, petrological interpretation for highway engineers, petrology, rock weathering, the clay minerals and their importance in engineering geology.

Quarrying and the Use of Explsives: Acquisition and administration of plant, estimating plant productivity and cost. Quarrying, crushing and screening. Types and application of explosives.

Seminar: One day seminar on maintenance requirements and methods.

20.212G
Road Construction—Part II

Highway Law: Highway law, the law of contracts, definition of a contract, five necessary elements for a valid contract. Operation and interpretation, fundamental principles and established practice, time for performance, discharge or dissolution, remedies for breach of contract, variations. Powers and duties of the engineer, agency, commercial arbitration, approvals, scope of obligations and authority, both legal and ethical, related contracts, carriage of goods by land, insurance, master and servant (contracts of employment), sale of goods, arbitration act.

Contract Documents: Engineering contracts types of contract, contract documents, general conditions of contract, drawings, specification, schedule or Bill of Quantities, tenders, letter of acceptance, the agreement, mechanics of execution of a contract, contract law in other countries. Specification, purpose and relationship to other contract documents, principles of specification writing, basic layout, method of approach and composition, bills of quantities, purpose and relationship to other contract documents, methods of presentation, principles of preparation and standard procedures, units.

Construction Surveying and Setting Out: Lectures on and field exercises in difficult construction and setting out problems.

Linear Programming and Critical Path Analysis: Introduction to operations research, critical path methods for planning and control, PERT techniques, available computer systems, administration of roadworks.

Use of Computers in Highway Engineering: Introduction to computers and programming, discussion of capabilities and limitations of integrated design systems used in highway design.

Statistics in Highway Engineering: Quality control, laboratory techniques, design of experiments.

Seminar: One day seminar on engineering management.

20.213G
Road Construction—Part III

Plant Operation and Earthworks: Construction plant, planning and supervision of earthmoving operations.

Construction Setting Out: Lectures on and field exercises in difficult construction and setting out problems.

Specifications Bills of Quantities: Specification writing, taking off and preparation of bills of quantities, plan presentation, certification of work for payment, progress payments, extras and additions estimating and economic comparison of projects, report writing.

20.221G
Road Construction—Part I (Surveyors)

Bituminous Materials: As for 20.211G.

Concrete: Kinds of cement and their principal properties, additives, mix design, placing and control of quality, compaction, curing testing of fresh and set concrete properties of concrete.

Aggregates: As for 20.211G.

Geology: As for 20.211G.

Quarrying and the Use of Explosives: As for 20.211G.

20.231G
Road Construction

Specifications, bills of quantities, engineering drawings for roadworks, feasibility and cost-benefit analyses, supervision of construction, progress payments, cost estimation, construction and personnel management, report writing.

Construction planning, use of critical path methods, setting out roadworks, selection and use of roadmaking plant including fixed and mobile units, quality control.

20.232G
Highway Materials

Selection, evaluation and specification of materials for flexible and rigid pavements and for road embankments. Forms and origings of bituminous materials and road tars, laboratory tests, seal-coats, primes and primseals, design of bituminous mixes, wearing courses, full depth asphalt pavements, manufacture of bituminous concrete, maintenance procedures.

Types of aggregates and their application, laboratory tests, relevance of tests to pavement performance, crushing, screening, grading of aggregates, durability of aggregates, blending procedures, quarrying and use of explosives, selection and testing of gravels.

Types of cement, additives, design of concrete mixes, transport and placing of concrete, compaction and curing, laboratory and in-situ tests, quality control.

20.311G
Highway Structures—Part I

Systems analysis in the choice of location and structure type of bridges, site investigation, foundation, waterways, aesthetics of design, design and planning constraints, optimum criteria, bridge structure analysis, orthotropic plate theory, articulated plate theory, theories of load distribution, matrix methods of analysis.

20.312G
Highway Structures—Part II

Bridge design—concrete, steel, prestressed concrete, culvert design and construction under high fills, foundation, sub-structure and retaining wall design, computer programs for design and optimization.

20.421G
Law and Administration

The law relating to the planning and construction of roads and highways and associated works, constructional law, industrial law, company law, Commonwealth and State laws relating to roadworks. Relevant sections and ordinances of Local Government and Main Roads Acts. Supervision and administration of contracts, interpretation of documents, organization of construction and maintenance works. Types of contract and their application, general conditions of contracts and responsibilities of engineer thereunder, sureties, guarantees, arbitration, drawings, specifications, bills of quantities, their function and inter-relationship, employment and discharge of labour, cost accounting, industrial awards.

20.430G
Highway Engineering Elective I

An occasional elective on a Highway Engineering topic selected according to current demand and availability of local and visiting specialists.

20.431G
Highway Engineering Elective II

An occasional elective on a Highway Engineering topic selected according to current demand and availability of local and visiting specialists.

20.501G
Management for Highway Engineers

Organization and Management: The purpose of management: planning, organizing, directing, coordinating. The qualities of managership: technical skill, human skill, conceptual skill.

Behavioural Science and Personnel Management: The psychological and sociological factors affecting organizational behaviour and affecting the individual. Perception, learning, motivation, conflict and frustration. Personality development and learning theory. Group dynamics, systems and subsystems, individual and group motivation, communications within the organization, leadership theory, the nature of authority, human engineering principles, techniques of personnel control. Recruitment, selection, promotion, job evaluation and salary administration, education, training, placement policies, incentive schemes. Staff reporting and counselling, appraisal and control of personnel. Public relations.

Decision Making: Planning: Highway planning and economics, cost control and accounting cost-benefit analyses. Network analysis as a planning aid, project control using critical path method, evaluation of works variations and delays, resource levelling. PERT method.

Decision Making: Dynamic programming, decision fees, Bayesian and other decistion making techniques. Operations Research techniques: Problems of allocation, the transport techniques, mathematical programming, the simplex method, inventory and queueing problems.

School of Nuclear Engineering

Undergraduate Study

23.051
Nuclear Power Technology L2½T½

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

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

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

Textbooks

No set texts.

Graduate Study

23.013G
Neutron Transport and Diffusion

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

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

23.015G
Multigroup Reactor Theories

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

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

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

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

A study of the theoretical models and numerical techniques required for the analysis of mechanical and thermal stress, deformation, and failure modes of reactor core components and containment structures under high temperature, neutron and gamma irradiation.

23.026G
Reactor Systems Analysis

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

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

23.028G
Reactor Accident and Safety Analysis

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

A course in mathematical methods, partial differential equations, special functions, and numerical methods for digital computation, relevant to Nuclear Engineering.

23.033G
Matrix Theory and Computation

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

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

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

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

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

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 utilisation.

23.909G
Project

23.918G
Research Project

23.936G
Research Project

School of Surveying

Undergraduate Study

29.001
Surveying IA — SS L3T2½

The scope and purpose of surveying. Instruments and methods. Theory and practice of data reduction. Levelling. Plane table surveying. Linear measurement. Angular measurement. Detail surveys. Traversing. Aspects of the history of surveying.

Textbooks

Seven Figure Mathematical Tables Full ed Chambers
Whyte W. S. *Revision Notes on Plane Surveying* Newnes-Butterworth

29.002
Surveying IB — SS L1T5½

Tacheometric surveys: calculation, plotting and contouring. Minor instruments. Surveying project embodying the selection of instruments and the design and application of field procedures. Introduction to plotting and plan drawing.

Textbooks

As for 29.001 Surveying IA.

29.102
Surveying II — SS, S1 + S2 L1¾T2¾

Control Surveys: plane triangulation with ten second theodolites, precise traversing. Contour surveys including optical distance measurement, calculation of areas, volumes, calculating and setting out curves.

Barometric and trigonometrical levelling. Hydrographic surveying. Introduction to use of one second theodolites.

Textbooks

No set texts.

29.103
Surveying III — SS L4T3

Electronic distance measurement, gyrotheodolites, compensators in levels and theodolites. Optical plumbing, deflection and settlement measurements, survey methods in industry, mine surveying. Gauss collimation technique, map reproduction, methods of preparation and reproduction of line maps. Other types of maps. Tape standardization, laboratory testing of instruments, error analysis in survey methods. Precision of formulae. Integrated surveys in general. Relocation of lost marks, special problems.

Textbooks

No set texts.

29.151
Survey Computations I — SS L3½T2½

Use of tables. Plane trigonometrical formulae. Calculation of triangles, areas, roadways, sub-divisions and curves. The use of calculating machines. Traverse computations including offsets and missing data problems. Areas from coordinates. Transformations. Spherical trigonometry and its application to survey problems. Resections and intersections: mathematical and semigraphic methods. Elementary programming for electronic computers.

Textbooks

Maughan M. *Survey Computations* School of Surveying Monograph No 5
Seven Figure Mathematical Tables Chambers
Tables of Natural Sines Tangents etc to every Ten Seconds DMR

29.152
Survey Computations II — SS L2T1

Revision of basic error theory. Adjustment by least squares 1. parametric method; 2. method of correlatives. Solution of Normal Equations by elimination methods 1. Gauss-Doolittle; 2. Cholesky. Error ellipse calculations.

Textbook

Maughan M. *Adjustment of Observations by least squares* School of Surveying Monograph No 6

29.161
Hydrographic Surveying I — SS L1T1

Principles, objectives, equipment and methods of hydrographic surveying.

29.162
Hydrographic Surveying II — SS L2T1

Not offered in 1976.

29.182
Cartography Elective — SS L1T1

Mathematical Cartography: map projections, Transverse Mercator, UTM and ISG. Topographic Cartography: representation of features, toponymy, map series. Thermatic Cartography. History of Cartography.

Textbook

Keates J. S. *Cartographic Design and Production* Longman

29.183
Cartography Advanced Elective — SS L2T1

Not offered in 1976.

29.192
Survey Camp

A two-week field camp, including the preparation of a report and plans.

Textbooks

As for 29.102 Surveying II and 29.151 Survey Computations I.

29.193
Professional Training

A five-month period of practical experience including the submission of a report.

29.194
Survey Camp

A two-week field camp followed by two weeks on campus for completion of computations.

Textbooks

As for 29.152 Survey Computations II, 29.211 Geodesy I, 29.311 Astronomy I and 29.511 Photogrammetry I.

29.211
Geodesy I — SS, S1 + S2 L4T2

Historical development of geodesy. The spheroid; curves on the spheroid. Legendres Theorem, computation of geographical co-ordinates. Geodetic surveying (types of horizontal control surveys). Procedures for angular observation. Surveyors projections. Applications to integrated surveys. Precise levelling.

Textbook

Mather R. S. *The Theory and Geodetic Use of some Common Projections* School of Surveying UNSW

29.212
Geodesy II — SS, S1 + S2 L2T1

A. Adjustment of control surveys using the condition and parametric methods of least square adjustment for measured angular and linear quantities. Variance/covariance matrix; variance factor; weight coefficient matrix. Elementary statistical testing of observations and adjusted values.

B. Relationship between geoid and ellipsoid; astro geodetic levelling; ellipsoidal elevations; mean sea level and the geoid. Methods for establishing a world geodetic system. Gravity and its use in geodesy.

29.213
Geodesy III — SS L2T1

Topics selected from: Calculations on the ellipsoid. The conformal projection of an ellipsoid. Atmospheric refraction and its effect on survey measurements. Adjustment of control surveys, precision of adjustment measurements, error ellipses of adjusted coordinates. The performance of geodetic position. Long range goals of geodesy. Seminar.

29.311
Astronomy I — SS L2T1

The celestial sphere and the astronomical triangle. Definitions, conventions and time. Latitude by circum-meridian and longitude by extra meridian methods. Best position, balancing Introduction to azimuth determination.

Textbooks

Mackie J. B. *The Elements of Astronomy for Surveyors* 6th ed Griffin
or
Textbook of Field Astronomy HMSO
Star Almanac for Land Surveyors for Current Year HMSO

29.312
Astonomy II — SS L2T1

Azimuth by circum-elongation, circum-polar and sun observations. Optimum position of observation, balancing of observations. Position line methods.

Textbook

Star Almanac for Land Surveyors for Current Year HMSO

29.313
Astronomy III — SS L2T1

A study of topics selected from the following: Corrections to observations and calculations; star coordinates; meridian methods; equal altitude methods; precise timing.

Textbook

As for 29.312 Astronomy II

29.411
Surveying for Architects — SS L1T1½

Introduction. Chaining, methods of measurement, corrections, chain surveys. Level, differential levelling. Contours, volumes of earthworks. Theodolite, methods of reading angles, applications in building. Traversing, setting out.

29.431
Surveying and Cartography — SS L2T2½

History of surveying and its relationship with town planning. Types of survey, methods of measurement, corrections, chain surveys. Level, differential levelling. Contours, volumes of earthworks. Theodolite, applications in building. Traversing, setting out. Basic concepts of land tenure, land registration and cadastral surveying. Outline of photogrammetry. Plotting. Preparation of plans, methods of enlargement and reduction, plan registration. Measurement of areas by planimeter.

29.441
Engineering Surveying — SS L2T4

Part A. Ordinary levelling. Angle measurement. Linear measurement (bands). Theodolite traversing. Tacheometry. Contour and detail surveys. areas and volumes.

Part B. Levelling (other methods). Linear measurement (electronic). Applications of survey techniques: control surveys, provision of information for design, setting out engineering works, etc. Outline of photogrammetry.

Textbooks

Bannister A. & Raymond S. *Surveying* Pitman Paperback
Seven Figure Mathematical Tables Chambers

29.491
Survey Camp

A one-week field camp.

Textbooks

As for 29.441 Engineering Surveying.

29.511
Photogrammetry I — SS L3T3

Stereoscopic Vission, Geometry of Single air photograph and stereoscopic pairs. Theory and practice of inner, Relative and Absolute orientation. Simple mapping methods. Cameras and physical properties of photographs.

Textbook

Moffit F. H. *Photogrammetry* 2nd ed International Textbook Co

29.512
Photogrammetry II — L1½T1½

Fundamental mathematical relationships. Design principles and practical applications of plotting instruments, Radial Triangulation. Methods of Aerial Triangulation. Aerial Mapping. Flight and project planning.

Textbook

As for 29.511 Photogrammetry I.

29.513
Photogrammetry III — SS L1½T1½

Topics selected from the following: Independent Model Triangulation, Analytical Photogrammetry. Propogation of errors in aerial triangulation. Strip and block adjustment. Camera calibration. Rectification, Mosaics, Orthophotography.

Textbooks

As for 29.511 Photogrammetry I.

29.612
Land Studies II — SS L4T1

1. *Land Valuation:* General principles of urban and rural land valuation. Unimproved and improved capital values. Valuation of leasehold and freehold land. Subdivisional value of land. Valuation of buildings. Relevant Acts and Regulations. N.S.W. Land and Valuation Court proceedings and decisions.

2. *Land Utilization:* A broad study of biological, political, social and economic factors establishing a concept of ecological relationships and the place of man therein. Primary industries and urbanization. Conservation of resources.

3. *Introducing Property Law:* The legal system, forms and sources of law; land tenure and property law.

Textbooks

Collins H. G. *Rural Land Utilization* Commonwealth Institute of Valuers
Costin A. B. & Frith H. J. *Conservation* Penguin
Murray J. F. N. *Principles and Practice of Valuation* C'wealth Inst of Valuers
or
Rost R. O. & Collins H. G. *Land Valuation and Compensation in Australia* C'wealth Inst of Valuers

29.613
Land Studies III — SS L2To

Land Titles and Survey Law: General study of land title systems; land tenure and title; the law of boundaries and of easements and other estates. The N.S.W. Real Property Act and other acts regulating the conduct of surveys and recording; field records, plans, title searches; surveyor's powers and duties. Cadastral Survey Systems. The N.S.W. Integrated Survey System.

Textbooks

Hallman F. M. *Legal Aspects of Boundary Surveyings as apply in NSW* Institution of Surveyors Sydney
Willis R. W. *Survey Investigation* Registrar-General's Dept

29.614
Land Studies Project — SS L1T2

A project involving the preliminary survey, analysis and all aspects of design for a development.

29.615
Land Studies — SS L2T1

Advanced studies in residential and industrial subdivisional design and presentation. Conflict of demand for land use; environmental control. Integrated survey applications. Data banks.

Graduate Study

29.154G
Adjustment of Observations

Choice of the mathematical model. Transformation of the model. Variance/covariance matrix for the observations. Variance factor. Weight of coefficient matrix. Condition method of least squares. Parametric method of adjustment. Statistical tests for the adjustment. Precision of adjusted variates. Error ellipses. Optimization of control surveys. Adjustment in phases. Parametric adjustment with conditions between the observations. Parametric adjustment with conditions between the parameters. Adjustment of minor order control to major control by means of transformations.

29.163G
Mathematical Methods I—Numerical Analysis

Finite and divided differences, interpolation formulae, curve fitting. Computational error analysis. Quadrature, numerical integration. Orthogonal polynomials, Fourier analysis. Exponential approximations. Iterative solutions of large blocks of linear equations.

29.164G
Mathematical Methods II—Statistics of Observations

Advanced applications to survey observations and least square adjustments of frequency distributions, variance, minimum variance, unbiased estimation, central limit theorum, multivariate distributions and statistical testing.

29.165G
Mathematical Methods III—Ellipsoidal Harmonics

Vector theorems. Theory of spherical and ellipsoidal harmonics.

29.215G
Geometrical Geodesy

Geometry of the ellipsoid. Calculation of geodesics and normal sections on the spheroid: various solutions and their merits. Computation in three dimensions. Atmoshnperic refraction: wave propagation in a heterogeneous medium, physics of lower atmosphere, calculation of corrections.

29.216G
Geodetic Surveying

Review of methods of geodetic surveying. Electronic distance measurement, angle measurement, characteristics of instruments, corrections to observations. Principles of satellite triangulation.

29.223G
Dynamic Geodesy

Orbital motion of near earth satellites; the analysis of satellite orbits for low degree harmonics of the earth's gravitational field; the application of results at the surface of the earth.

29.224G
Physical Geodesy

Fundamental equations for the solution of the boundary value problem; telluroid; solutions to the order of the flattening. The gravitational field of the rotating spheroid. The analysis of gravity; extension techniques. Astro-geodetic levelling; comparison of gravimetric and astro-geodetic solutions. The determination of the earth's gravitational field from satellite orbital analysis. The combination of satellite and surface gravity data. Computational data.

29.314G
Geodetic Astronomy

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.

29.517G
Theory of Optical Mechanical Photogrammetric Orientation

Fundamental projective relationships. Empirical, numerical, and graphical solutions. Special cases, partial overlaps, mountainous terrain. Observation procedures. Instrumental procedures for Absolute Orientation. Model deformations due to errors of interior and relative orientation. Accuracy of photogrammetric restitution.

29.518G
Theory of Analytical Photogrammetric Orientation

Fundamental relationship. Correction of image coordinates. Photographic and model coordinate systems. Condition equations. Transformation equations for absolute orientation. Comparators, computer programs.

29.519G
Photogrammetic Instrumentation

Theory of instruments; stereocomparators, restitution instruments, approximate instruments, ancillary equipment. Testing and calibration of instruments.

29.520G
Photogrammetric Production Processes

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry.

29.521G
Aerial Triangulation

Prerequisite: 29.518G

Aerial triangulation; optical-mechanical methods; analytical methods, sequential and simultaneous; strip adjustment, computer programs.

29.522G
Block Adjustment

Prerequisite: 29.521G

Block adjustment; polynomial, independent model, purely analytical. Adjustments with parameter constraints. Advanced computational techniques. Accuracies of adjustment.

Division of Postgraduate Extension Studies

Graduate Study

97.001G
Linguistics and the Art and Practice of Written and Spoken Communication

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, structionalist, generative and transformationalist; specific matters in theoretical dispute; eg the statistics of the phoneme; experimental and instrumental research; eg spectrographic examinations of English sounds and their combination; correlations between acoustic phenoma and the perceived sounds of English; the statistics of written and spoken English. Types of communication problems; establishing identity of purpose or common ground; essential differences between written and spoken English; limitation of words; visual aids to comprehension; preparation of factual or technical reports; preparation of a technical lecture.

97.002G
Basic Information Theory

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. Principles of programming and data processing.

97.004G
The Psychology of Communication

The basic communication process analysed in terms of Source, Medium/Message, Respondent and Effects. A social context theory of communication relating the influence of groups, roles, social class, power, status etc on communication. Attitude change through communication. Elementary statistics and statistical analyses in the experimental study of communication.

97.005G
Audio and Video Equipment—Capabilities and Applications

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, NTSC and SECAM colour television systems; switching, mixing and processing of television signals; lighting equipment; studio floor equipment.

Printing processes; letterpress, gravure and lithography. Photography.

97.007G
Audio and Video Signals in Communication

Wave-theory. Propagation through media. Studio and free space acoustics. Measurem ent of loudness and noise. Signal fidelity.

Light in electromagnetic spectrum. Chrominance—hue and saturation. Chromaticity diagram and colour triangle. Measurement of illumination and brightness.

97.008G
The Body in Communication

Vocal organs. Phonation. Formant patterns of speech. Acoustic specifications of speech. Mechanism and characteristics of the ear. Mechanism and characteristics of the eye. Vision defects and illusions. The brain. Neurological signal transmission characteristics.

97.009G
Presentation of Information

Use of audio plus video still displays. Instructional radio production. Audio plus animated video displays. Instructional television and film production. Communication in education.

97.010G
Basic Fortran

Introduction to computer programming in FORTRAN IV for people with no computer experience and no mathematical training beyond High School mathematics. Practice at programming and debugging, with problems taken from both data processing and scientific applications. Input and Output FORMAT statements; Nested DO loops; Arithmetic statement functions; Matrix arrays; Implied DO loops; Magnetic tape and disc READ and WRITE statements; Function subprograms and subroutine programs; Sorting and merging techniques; Common Storage; Program planning and debugging.

97.031G
Linguistics, and Written and Spoken Communication

As for 97.001G (lectures only).

97.032G
Basic Information Theory

As for 97.002G (lectures only).

97.034G
Psychology of Communication

As for 97.004G (lectures only).

97.035G
Audio Video Equipment

As for 97.005G (lectures only).

97.037G
Audio Video Signals in Communication

As for 9.007G (lectures only).

97.038G
The Body in Communication

As for 97.008G (lectures only).

97.039G
Presentation of Information

As for 97.009G (lectures only).

Non-Engineering Subjects

Physics

Physics Level I units

1.001
Physics I — S1 + S2 L3T3

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

The application of wave and particle theories in physics. A review of the atomic theory of matter and the structure and properties of atomic nuclei. A molecular approach to energy transfer, kinetic theory, gas laws and calorimetry. The wave theories of physics, transfer of energy by waves, properties of waves. Application of

wave theories to optical and acoustical phenomena such as interference, diffraction and polarization. Interaction of radiation with matter, photoelectric effect, Compton effect, spectroscopy. Resolution of the wave—particle paradox by means of wave mechanics and the uncertainty of principle.

Textbook

Weidner R. T. & Sells R. L. *Elementary Physics, Classical and Modern* Allyn & Bacon

1.101
Physics I (Part 1) — S1 L3T3

For Surveying students doing the sandwich course.

The syllabus is identical with 1.001, Session 1.

1.202
Physics I (Part 1) — S2 L3T3

For Surveying students doing the sandwich course.

The syllabus is identical with 1.001, Session 2.

1.011
Higher Physics I — S1 + S2 L3T3

For students of all Faculties except Medicine and Architecture who have a good secondary school record and who wish to do a more challenging course.

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

Textbooks

Russell G. J. & Mann K. *Alternating Current Circuit Theory* NSW Univ Press
Weidner R. T. & Sells R. L. *Elementary Physics, Classical and Modern* Allyn & Bacon

Physics Level II units

The units are at two levels, an ordinary level, prefix 1.112, and a higher level, prefix 1.122:

1.112A
Electromagnetism — S2 L2½T3½

Electrostatics in vacuum and in dielectrics. Magnetostatics in vacuum and in magnetic materials. Maxwell's equations and simple applications.

Textbook

Parton J. E. & Owen S. J. T. *Applied Electromagnetics* Mac Press

1.112B
Modern Physics — S1 L2½T3½

Special theory of relativity, Lorentz transformation, relativistic mass momentum and energy: Schrodinger wave equation expectation values, operators, eigenfunctions, eigenvalues, free-particle, bound-particle and applications to physical systems, spectra, electron spin, spin-orbit coupling, exclusion principle, origins and spectra of X-rays, electron energy levels in solids.

Textbook

Arya A. P. *Elementary Modern Physics* Addison-Wesley

1.112C
Thermodynamics and Mechanics — S1 + S2 L1½T½

Thermodynamics: Kinetic theory of gases. Equipartition of energy. Maxwell-Boltzmann distribution law. First and second laws of thermodynamics. Statistical foundations of thermodynamics. Entropy and the entropy principle. Thermodynamic functions. Phase changes. Joule-Kelvin effect.

Mechanics: Properties of solids and liquids, eleasticity, hydrostatics, hydrodynamics, vibration of systems with one degree of freedom, S.H.M., superposition, damped S.H.M., forced vibration, resonance, Fourier analysis, vibrations of coupled systems, Lagrangian mechanics, oscillations and continuous systems, waves, wave packet group velocity.

Textbooks

French A. P. *Vibrations and Waves* Nelson
Mandl F. *Statistical Physics* Wiley
Stephenson R. J. *Mechanics and Properties of Matter* Wiley

1.122A
Electromagnetism — S2 L2½T3½

Electrostatics, Gauss' theorem. Dipoles. Dielectrics. Electric displacement. Poisson's and Laplace's equations. Electrical images. Classical theory of conduction. Magnetic effects of currents. Magnetic shells. Magnetic scalar potential. Magnetostatics. B and H. Ferromagnetism. Maxwell's equations of e.m. field. Poynting vector. Plane waves in isotropic dielectric and conducting media. Reflection, refraction at the boundary of two dielectrics. Reflection from surface of metal.

Textbook

Lorrain P. & Corson D. *Electromagnetic Fields and Waves* 2nd ed Freeman

1.122B
Quantum Physics — S1 L2½T3½

Introductory relativity theory, kinematics and mechanics. Electrons and quanta, the photoelectric effect, Compton effect. The nuclear atom. Atomic stability. Atomic spectra. Bohr theory. Particles and waves and Schrodinger's equation. The free particle. Step potentials. The one electron atom. The exclusion principle. X-rays, origin and spectra. Electron energy levels in solids.

Textbook

Eisberg R. M. *Fundamentals of Modern Physics* Wiley

1.122C S1 + S2 L1½T½
Thermodynamics and Mechanics

First and second laws of thermodynamics. Thermodynamic equilibrium, and reversibility. Kelvin temperature scale. Entropy. Thermodynamic functions and Maxwell's relationships. Application of thermodynamics to different systems. Maxwell-Boltzmann velocity distribution law. Oscillators. Vibrating strings. Motion of system of particles. Lagrange's equations. Variational principles. Hamilton's equations of motion. Transport properties of a gas.

Textbooks

Mandl F. *Statistical Physics* Wiley
Symon K. R. *Mechanics* 2nd ed Addison-Wesley

Chemistry

2.001
Chemistry I S1 + S2 L2T4

Classification of matter and theories of the structure of matter. Atomic structure, the periodic table and chemical behaviour. Chemical bonding, molecular structure and stereochemistry. Chemical kinetics and equilibrium; enthalpy, free energy and entropy changes in chemical systems. The structure, nomenclature and properties of organic and inorganic compounds. Reactions of organic and inorganic compounds.

Textbooks

Aylward G. H. & Findlay T. J. V. *SI Chemical Data* Wiley Sydney
Chemistry I—Laboratory Manual Univ of NSW
De Puy C. H. & Rinehart K. L. *Introduction to Organic Chemistry* 2nd ed Wiley Int
Mahan B. H. *University Chemistry* 3rd ed Addison-Wesley

2.021
Chemistry IE S1 *or* S2 L3T3

A terminating subject for students in the Aeronautical, Civil, Electrical, Industrial, Mechanical and Mining Engineering, and Naval Architecture courses.

Classification of matter and theories of the structure of matter. Atomic and molecular structure, the periodic table and chemical behaviour. Chemical bonding and the nature and properties of chemical systems. Equilibrium and energy changes in chemical systems. Introduction to colloidal systems.

Textbooks

Aylward G. H. & Findlay T. J. V. *SI Chemical Data* Wiley
Barrow G. M. Kenney M. E. Lassila J. D. Litle R. L. & Thompson W. E. *Understanding Chemistry* Benjamin
Brescia F. Arents J. Meislich H. & Turk A. *Fundamentals of Chemistry* 3rd ed Academic Press
Chemistry IE Laboratory Manual Univ of NSW

Metallurgy

4.913
Materials Science S1 + S2 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 metllic 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.

Textbook

Clark D. S. & Varney W. R. *Physical Metallurgy for Engineers* Van Nostrand

4.921
Materials Science S1 + S2 L1T0

The atomic structure of metals. The crystalline nature of metals and its significance. The solidification of metals. Plastic deformation of crystalline materials and its effect on properties. Phase equilibria in metallic alloys. The heat treatment of some ferrous and non-ferrous alloys. Corrosion. The electron theory of metals. Conductors, semi-conductors and insulators. Magnetic materials—structure and properties.

Textbook

Barrett C. R. Nix W. D. & Tetleman A. S. *The Principles of Engineering Materials* Prentice-Hall

4.931
Metallurgy SS L2T1

For students of Civil Engineering. Part of 8.272 Civil Engineering Materials I.

The atomic structure of metals. The grain structure of metals; origin; effects of manufacturing processes. Structure of alloys—theory. Structure, properties and heat treatment of commercially important alloys. The selection and properties of structural steels. Corrosion.

Textbooks

As for 4.921 Materials Science.

4.941
Metallurgy for Engineers S1 + S2 L1

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

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

creep. Corrosion and oxidation of metals. Specification and selection of engineering alloys.

Textbooks

As for 4.921 Materials Science.

Mathematics

10.001
Mathematics I — S1 + S2 L4T2

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, an introduction to computer programming.

Textbooks

Blatt J. M. *Basic Fortran IV Programming* Miditran Version Computer Systems (Aust)
Shields P. C. *Elementary Linear Algebra* 2nd ed Worth
Thomas G. B. *Calculus and Analytic Geometry* 4th ed Addison-Wesley

Preliminary Reading List

Allendoerfer C. B. & Oakley C. O. *Principles of Mathematics* McGraw-Hill
Bell E. T. *Men of Mathematics* 2 Vols Pelican
Courant R. & Robbins H. *What is Mathematics?* OUP
Polya G. *How to Solve It* Doubleday Anchor
Sawyer W. W. *A Concrete Approach to Abstract Algebra* Freeman
Sawyer W. W. *Prelude to Mathematics* Pelican

10.011
Higher Mathematics I — S1 + S2 L4T2

Calculus, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

Textbooks

Blatt J. M. *Basic Fortran IV Programming* Miditran Version Computer Systems (Aust)
Spivak M. *Calculus* Benjamin

Preliminary reading List

As for 10.001 Mathematics I plus:

Arnold B. H. *Intuitive Concepts in Elementary Topology* Prentice-Hall
David F. N. *Games Gods and Gambling* Griffin
Felix L. *The Modern Aspect of Mathematics* Science Editions
Huff D. *How to Lie with Statistics* Gollancz
Reid C. *From Zero to Infinity* Routledge & Kegan Paul

10.022
Engineering Mathematics II — S1 + S2 L2T2

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

Textbook

Keane A. Senior S. A. Giles E. & Prokhovnik S. J. *Mathematical Methods* 3rd ed Science Press
(Alternatively:
Giles E. Pretorius W. J. & Prokhovnik S. J. *Supplement to Mathematical Methods* Science Press
and Keane A. & Senior S. A. eds. *Mathematical Methods* 2nd ed Science Press)

10.033
Electrical Engineering Mathematics III — S1 + S2 L2T0

Selections from the following topics: Inversion theorem for Laplace transforms. Step and pulse functions and their transforms. Fourier transforms. Transmission line problems. Potential theory. Electromagnetic theory. Wave equations, orthonormal functions. Calculus of variations. Lagrangian and Hamiltonian mechanics.

Textbook

Groden C. M. McKeegan D. J. & Kirkpatrick C. B. *Mathematics for Electrical Engineers* Notes issued by the School of Mathematics

10.111A
Pure Mathematics II—Linear Algebra — S1 + S2 L1½T½

Vector Spaces: inner products, linear operators, spectral theory, quadratic forms. Linear Programming: convex sets and polyhedra, feasible solutions, optimality, duality.

Textbook

Tropper A. M. *Linear Algebra* Nelson Paperback

10.111B
Pure Mathematics II—Analysis — S1 + S2 L1½T½

Real analysis: partial differentiation, multiple integrals. Analysis of real valued functions of one and several variables. Complex analysis: analytic functions, Taylor and Laurent series, integrals, Cauchy's theorem, residues, evaluation of certain real integrals, maximum modulus principles.

Textbooks

Session 1
Kolman B. & Trench W. F. *Elementary Multivariable Calculus* Academic

Session 2
Churchill R. V. *Complex Variables and Applications* ISE McGraw-Hill

10.211A
Applied Mathematics II—Mathematical Methods — S1 + S2 L1½T½

Review of functions of two and three variables, divergence, gradient, curl; line, surface, and volume integrals; Green's and Stokes' theorems. Special functions, including gamma and Bessel functions. Differential equations and boundary value problems, including vibrating string and vibrating circular membrane; Fourier series.

Textbooks

Blatt J. M. *Basic Fortran IV Programming* M iditran Version Computer Systems (Aust)
Sneddon I. N. *Fourier Series* Routledge
Spiegel M. R. *Advanced Mathematics for Scientists and Engineers* Schaum
Spiegel M. R. *Theory and Problems of Vector Analysis* Schaum

10.341
Statistics SU — S1 + S2 L1T½

An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood; 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.

Textbooks

Freund J. E. *Mathematical Statistics* Prentice-Hall
or
Kreizig E. *Introductory Mathematical Statistics* Wiley
Statistical Tables

Statistics

10.351
Statistics SM — S1 + S2 L1T½

For students in Aeronautical, Industrial and Mechanical Engineering and Naval Architecture as part of 5.071 Engineering Analysis.

An introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial, Poisson and normal distributions. Sampling distributions, with emphasis on those derived from the normal distribution: t, χ^2 and F. Estimation of parameters: the methods of moments and maximum likelihood, and confidence interval estimation. The standard tests of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

Textbooks

As for 10.341 Statistics SU.

10.361
Statistics SE — S1 + S2 L1T½

For students in Electrical Engineering.

As for 10.351 Statistics SM, with the addition of auto-correlation.

Textbooks

As for 10.351 Statistics SM.

Accountancy

14.001
Introduction to Accounting A — SS 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.

Textbook

Thacker R. J. *Introduction to Modern Accounting* (with student guide) 2nd ed Prentice-Hall

14.002
Introduction to Accounting B — ¼S 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.

Textbook

Horngren C. T. *Accounting for Management Control: An Introduction* 3rd ed Prentice-Hall

Industrial Relations

15.501
Introduction to Industrial Relations

For students enrolled in Faculties other than Commerce and Arts. It is designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Topics covered include: the origins, evolution and operation of the Australian system of industrial relations; the structure and role of trade unions and employer bodies; the function of industrial tribunals such as the Australian Conciliation and Arbitration Commission and the N.S.W. Industrial Commission; wages structure and determination; employment, unemployment and retraining; the nature and causes of strikes and other forms of industrial conflict; the processes and procedures for conflict resolution.

Where appropriate to class composition, particular attention is paid to individual industries.

Preliminary Reading

*Hyman R. *Strikes* Fontana
*Martin R. *Trade Unions in Australia* Penguin
Portus J. H. *Australian Compulsory Arbitration 1900-1970* Hicks Smith

Textbooks

*Isaac J. E. & Ford G. W. eds *Australian Labour Relations Readings* 2nd ed Sun Books
*Niland J. R. & Isaac J. E. eds *Australian Labour Economics Readings* Sun Books
*Rosow J. M. ed *The Worker and the Job: Coping with Change* Prentice Hall

*Paperback.

Geography

27.295
Physical Geography for Surveyors S2 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.

Textbook

Strahler A. N. *An Introduction to Physical Geography* Wiley

Optometry

31.212
Geometrical Optics L1½T1½

The concept of the ray of light and the point image. Reflection. Fresnel's laws. Refraction. The thin lens. The thick lens and lens systems. Instruments and their aberrations. Introduction to optical computations. Photometry.

Textbook

Fincham, W. H. A. & Freeman M. H. *Optics* 8th ed Butterworths

Town Planning

36.411
Town Planning SS L2T0

The urban planning process. The industrial and urban revolution. Regional planning concepts. Housing and new towns. Civic design. Human environment. Social planning: societal values and societal organization. Social planning: public participation, quality of life. Planning law and administration. Levels of planning and types of plans. Ecological land use planning. Uses of the Lowry Model. Metropolitan planning concepts with particular application to Sydney and Canberra. Neighbourhood planning. The future city.

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										

The University of New South Wales Kensington Campus 1979

Theatres

Biomedical Lecture Theatres **E27**
Central Lecture Block **E19**
Classroom Block (Western Grounds) **H3**
Electrical Engineering Theatre **F17**
Keith Burrows Lecture Theatre **J14**
Mathews Theatres **D23**
Old Main Theatrette **K15**
Parade Theatre **E3**
Science Theatre **F13**
Sir John Clancy Auditorium **C24**

Buildings

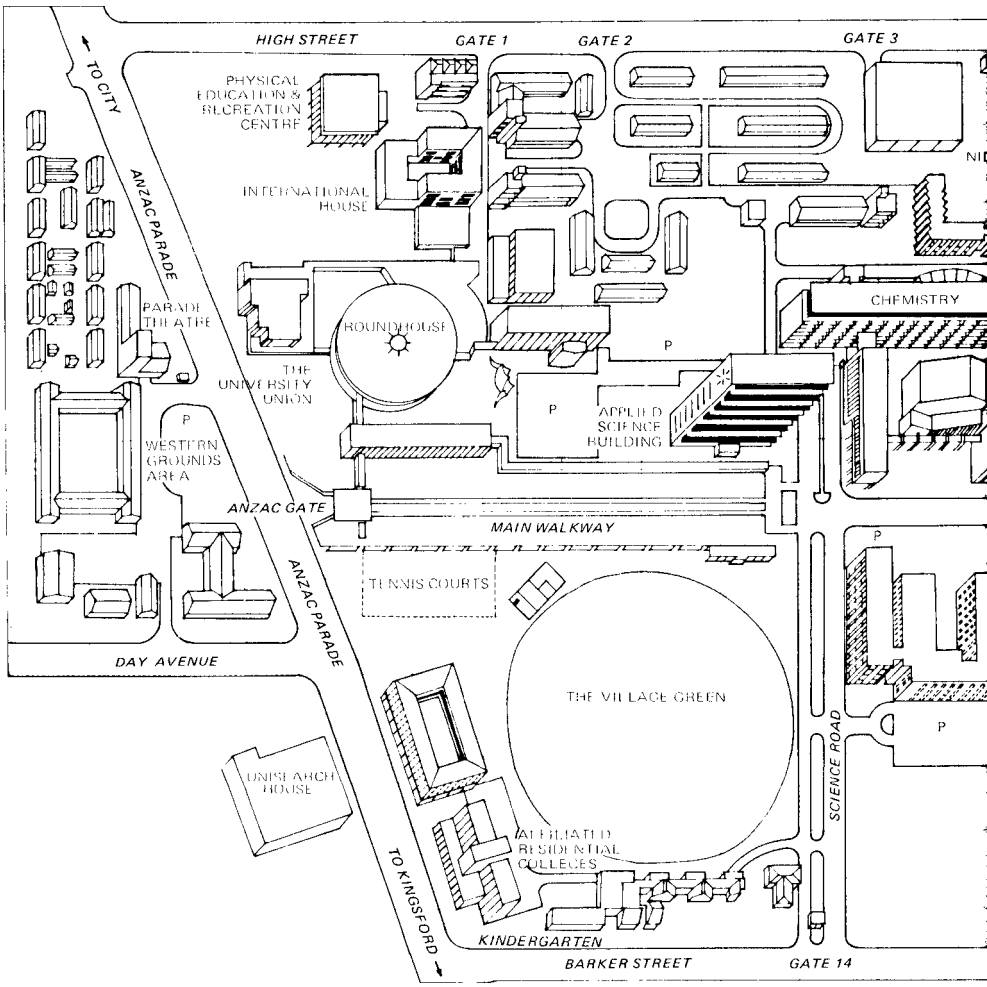
Affiliated Residential Colleges
New (Anglican) **L6**
Shalom (Jewish) **N9**
Warrane (Roman Catholic) **M7**
Applied Science **F10**
Architecture **H14**
Arts (Morven Brown) **C20**
Banks **F22**
Barker Street Gatehouse **N11**
Basser College **C18**
Biological Sciences **D26**
Central Store **B13**
Chancellery **C22**
Chemistry
Dalton **F12**
Robert Heffron **E12**
Civil Engineering **H20**
Commerce (John Goodsell) **F20**
Dalton (Chemistry) **F12**
Electrical Engineering **G17**
Geography and Surveying **K17**
Goldstein College **D16**
Golf House **A27**
Gymnasium **B5**
House at Pooh Corner **N8**
International House **C6**
John Goodsell (Commerce) **F20**
Kensington Colleges **C17**
Basser **C18**
Goldstein **D16**
Philip Baxter **D14**
Main Building **K15**
Maintenance Workshop **B13**
Mathews **F23**
Mechanical and
Industrial Engineering **J17**
Medicine (Administration) **B27**
Menzies **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**
Unisearch House **L5**
University Regiment **J2**
University Union
(Roundhouse) — Stage I **E6**
University Union
(Blockhouse) — Stage II **G6**
University Union
(Squarehouse) — Stage III **E4**
Wallace Wurth School of Medicine **C27**
Warrane College (Roman Catholic) **M7**
Wool and Pastoral Sciences **B8**

General

Accountancy **C20**
Admissions Office **C22**
Anatomy **C27**
Applied Geology **F10**
Applied Science (Faculty Office) **F10**
Appointments Office **C22**
Architecture
(including Faculty Office) **H14**
Arts (Faculty Office) **C20**
Australian Graduate
School of Management **F23**
Biochemistry **D26**
Biological Sciences (Faculty Office) **D26**
Biological Technology **D26**
Biomedical Library **F23**
Bookshop **G17**
Botany **D26**
Building **H14**
Cashier's Office **C22**
Centre for Medical Education
Research and Development **C27**
Chaplains **E15a**
Chemical Engineering **F10**
Chemical Technology **F10**
Chemistry **E12**
Child Care Centre **N8**
Civil Engineering **H20**
Closed Circuit Television Centre **F20**
Commerce (Faculty Office) **F20**
Community Medicine **D26**
Computing Services Unit **E21**
Drama **D9**
Economics **F20**
Education **G2**
Electrical Engineering **G17**
Engineering (Faculty Office) **K17**
English **C20**
Examinations and Student Records **C22**
Fees Office **C22**
Food Technology **F10**
French **C20**
General Studies **C20**
Geography **K17**
German **C20**
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 **B8**
Kindergarten *(House at Pooh Corner/*
Child Care Centre) **N8**
Landscape Architecture **H14**
Law (Faculty Office) **E21**
Law Library **E21**
Librarianship **B10**
Library **E21**
Lost Property **F20**
Marketing **F20**
Mathematics **F23**
Mechanical Engineering **J17**
Medicine (Faculty Office) **B27**
Metallurgy **E8**
Microbiology **D26**
Mining Engineering **K15**
Music **B11**
National Institute of Dramatic Art **C15**
Nuclear Engineering **G17**
Optometry **J12**
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 Committee
in Medical Education **B27**
Postgraduate Extension Studies (Closed
Circuit Television) **F20**
Postgraduate Extension Studies (Radio
Station and Administration) **F23**
Psychology **F23**
Public Affairs Unit **C22**
Regional Teacher Training Centre **C27**
Russian **C20**
Science and Mathematics Course
Office **F23**
Social Work **E1**
Sociology **C20**
Spanish and Latin American Studies **C20**
Student Amenities and Recreation **E15c**
Student Counselling and Research **E15c**
Student Employment **C22**
Student Health **E15**
Students' Union **E4**
Surveying **K17**
Teachers' College Liaison Office **F16**
Tertiary Education Research Centre **E15d**
Textile Technology **G14**
Town Planning **K15**
University Union (Blockhouse) **G6**
Wool and Pastoral Sciences **B8**
Zoology **D26**

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										



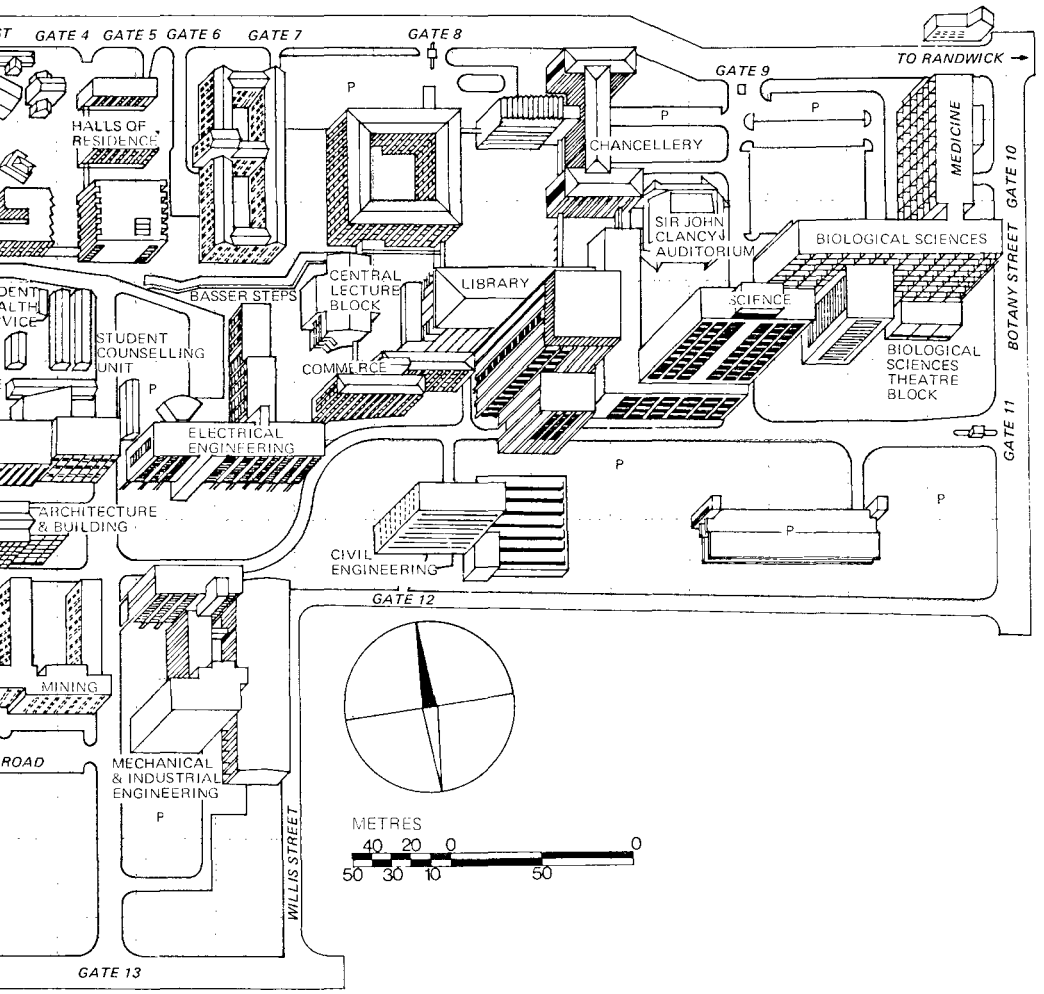
THE UNIVERSITY OF NEW SOUT

BUILDINGS

Applied Science F11
Architecture H15
Banks F22, F7
Basser College B18
Biological Sciences D26
Biological Sciences Extensions E25
Biomedical Lecture Theatres E27
Central Lecture Block E19
Central Store B13
Chancellery B/C 22
Child Minding Centre N8
Civil Engineering H20
Cracknell Sports Pavilion H8
Dalton (Chemistry) G12
Electrical Engineering G17
Electrical Engineering Lecture Theatre F17
Goldstein College B/C/D16
International House C7
John Goodsell (Commerce) F20
Keith Burrows Lecture Theatre H14
Kensington College C15/16/17
Library - Stage 2 F21/22
Main Building J/K13/14/15/16
Maintenance Workshop B13
Mechanical Engineering H17
Medicine (Administration) B27
Menzies Library E21/22
Metallurgy E8/9
Morven Brown (Arts) C/D19/20
New College (Anglican) K/L6
Newton Building J/K12
National Institute of Dramatic Art C15
Old Main Theatrette J14
Parade Theatre and Old Tote Theatre Company E3
Philip Baxter College D13/14/15
Physical Education and Recreation Centre B5/6
Robert Heffron (Chemistry) E12/13
Sciences Building F23/24
Science Lecture Theatre Block D23
Science Theatre F13
Shalom College (Jewish) M9/10
Sir John Clancy Auditorium D23/24
Sir Robert Webster (Textiles) G14/15
Squash Courts B7
Union (Roundhouse) – Stage I E/F 6/7
Union (Blockhouse) – Stage II F6/7
Union (Squarehouse) – Stage III D/E5
Union (Golf House) – Subsidiary A27
Unisearch House L5
University Regiment H3
Wallace Wurth School of Medicine C26
Warrane College (Roman Catholic) M6/7
Western Campus A J 2/3, H/J 3/4
Wool and Pastoral Sciences B8

GENERAL

Accountancy C20
Admissions Office B22
Aeronautical Engineering J/K/L18
Anatomy C26
Applied Geology F11
Applied Physics J12
Applied Science (Faculty Office) F11
Appointments Office B22
Architecture (including Faculty Office) H15
Arts (Faculty Office) D20
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biological Technology D26
Biomedical Library D27
Bookshop G17
Botany D26
Building H15
Cashier's Office B22
Centre for Medical Education Research and Development E24
Ceramic Engineering D12
Chemical Engineering F11
Chemical Technology F11
Chemistry E12/13, F/G12



WALES KENSINGTON CAMPUS

Civil Engineering H20
Clancy Auditorium D23/24
Closed Circuit Television Centre F20
Commerce (Faculty Office) F20
Community Medicine E25
Computer Centre F18
Drama D9
Economics F20
Education F2/3
Electrical Engineering G17
Engineering (Faculty Office) H17
English C20
Examinations and Student Records B22
Fees Office B22
Finance F20
Food Technology F11
French C21
Fuel Technology F11
General Studies C20
Geography F11
German C20
Graduate School of Business F20
Health Administration C23
History C20
History and Philosophy of Science C20
Human Genetics C26
Industrial Arts C2
Industrial Engineering H17
Institute of Administration G3
Institute of Languages G14
Institute of Rural Technology B9
Landscape Architecture H15
Law (Faculty Office) F23/24
Law Library F23/24
Librarianship B9/10
Library E21/22
Marketing F20
Mathematics F23/24
Mechanical Engineering H17
Medical Microbiology C26
Medicine (Faculty Office) B27
Metallurgy E8/9
Microbiology D26
Mining Engineering K16
Music B11
National Institute of Dramatic Art C15
Naval Architecture H17
Nuclear Engineering F18
Optometry J12
Pathology C26
Philosophy C20
Physics K13/14/15
Physics (Applied) J12
Physiology and Pharmacology C26
Political Science B/C19
Polymer Science C8
Postgraduate Committee in Medical Education B27
Postgraduate Extension Studies (Closed Circuit TV) F20
Postgraduate Extension Studies (Radio Station and Administration) F23/24
Psycholcgy F23/24
Public Information C22
Russian D20
Science (Faculty Office) K14
Shalom College M9/10
Social Work F2/3
Sociology C21
Spanish and Latin American Studies D19
Student Amenities Office E16
Student Counselling Unit E16
Student Employment F15
Student Health Service E15
Students' Union E5
Superintendent (Patrol & Cleaning Services) F20
Surveying H20
Teachers' College Liaison Officer F16
Tertiary Education Assistance Centre E16
Textile Technology G14/15
Town Planning J/K16
University Union E/F6
Water Research Foundation H20
Wool and Pastoral Sciences B8
Zoology D26

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, conditions for the award of degrees, scholarships, prizes, and so on, you should consult the Calendar.

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 General Education.

The Calendar and Handbooks are available from the Cashier's Office. The Calendar costs $3 (hard cover) and $2.50 (soft cover) (plus postage and packing, 90 cents). The Handbooks vary in cost. **Applied Science, Arts, Commerce** and **Science** are $1.50: **Architecture, Engineering, Law, Medicine** and **Professional Studies** are $1.00. Postage is 40c in each case. The exception is **General Studies**, which is free.