FACULTY OF ENGINEERING

1975 HANDBOOK

THE UNIVERSITY OF NEW SOUTH WALES

ONE DOLLAR

SOME PEOPLE WHO CAN HELP YOU

Note: All phone numbers below are University extension numbers. If you are dialling from outside the University dial 663 0351 and ask for the extension.

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

continued on inside back cover

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THE UNIVERSITY OF NEW SOUTH WALES
P.O. Box 1, Kensington, N.S.W. 2033
Phone: 663 0351

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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.

Index to General Information

Calendar of Dates for 1975

Session 1: March 3 to May 11
May Recess: May 12 to May 18
May 19 to June 15
Midyear Recess: June 16 to July 20
Session 2: July 21 to August 24
August Recess: August 25 to August 31
September 1 to November 2
Study Recess: November 3 to November 9

JANUARY

Wednesday 1	New Year's Day—Public Holiday
Friday 10	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 13	Timetables for *deferred* examinations available
Friday 17	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 27	Australia Day—Public Holiday
Tuesday 28	*Deferred* examinations begin

FEBRUARY

Saturday 8	*Deferred* examinations end
Friday 14	Last day for appeal against exclusion by students who infringed re-enrolment rules at *annual* examinations
Monday 17	Enrolment period begins for new students and students repeating first year
Friday 21	*Deferred* examination results available
Monday 24	Enrolment period begins for second and later year students
Tuesday 25	Last day for application for review of *deferred* examination results
Friday 28	Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *deferred* examinations

MARCH

Monday 3	**Session 1 commences**
Friday 14	Last day for acceptance of enrolments by new students (late fee payable)
Thursday 20	Last day for appeal against exclusion by students who infringed re-enrolment rules at *deferred* examinations
Thursday 27	Last day for changes in course programmes
	Last day for acceptance of enrolments by students re-enrolling in second and later years (late fee payable)
Friday 28 to Monday 31	Easter

APRIL	
Thursday 3	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over Session 1 only
Thursday 24	Last day for students attending a university for the first time to discontinue without failure subjects which extend over Session 1 only
Friday 25	Anzac Day—Public Holiday
MAY	
Tuesday 6	Publication of provisional timetable for June/July examinations
Monday 12	**May Recess begins**
Tuesday 13	Last day for acceptance of corrected enrolment details forms
Friday 16	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over the whole academic year
Sunday 18	**May Recess ends**
Monday 19	Last day for students to advise of examination timetable clashes
JUNE	
Tuesday 3	Publication of timetable for June/July examinations
Sunday 15	**Session 1 ends**
Monday 16	Queen's Birthday—Public Holiday **Midyear Recess begins**
Tuesday 17	Midyear examinations begin
JULY	
Tuesday 1	Midyear examinations end
Sunday 20	**Midyear Recess ends**
Monday 21	**Session 2 begins**
Thursday 31	Foundation Day
AUGUST	
Friday 1	Last day for students attending a university for the first time to discontinue without failure subjects which extend over the whole academic year
Thursday 21	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 25	**August Recess begins** Holiday for non-academic staff
Sunday 31	**August Recess ends** Last day for acceptance of applications for re-admission in 1976 after exclusion under the re-enrolment rules
SEPTEMBER	
Friday 12	Last day for students attending a university for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 15	Last day for return of corrected enrolment details forms Last day for applications from students graduating in 1976 for admission to University degrees and diplomas
Tuesday 23	Publication of provisional timetable for annual examinations

OCTOBER

Wednesday 1	Last day to apply to MUAC for transfer to another university in Sydney metropolitan area and Wollongong
Friday 3	Last day for students to advise of examination time-table clashes
Monday 6	Eight Hour Day—Public Holiday
Tuesday 21	Publication of timetable for annual examinations

NOVEMBER

Monday 3	**Study Recess begins**
Sunday 9	**Session 2 ends**
Monday 10	Annual examinations begin

DECEMBER

Tuesday 2	Annual examinations end
Thursday 25	Christmas Day—Public Holiday
Friday 26	Boxing Day—Public Holiday

1976

Session 1:	March 1 to May 9
	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
	August Recess: August 23 to August 29
	August 30 to October 31
	Study Recess: November 1 to November 7

JANUARY

Friday 9	Last date for application for review of results of annual examinations
Monday 12	Publication of timetable for deferred examinations
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
Friday 20	Results of deferred examinations available
Monday 23	Enrolment period begins for second and later year students

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 1974 the University had 17,355 students and 3,958 staff who worked in more than eighty buildings. If staff and students at Broken Hill (W. S. and L. B. Robinson University College), Wollongong (an autonomous university in 1975), Duntroon (the Faculty of Military Studies) and Jervis Bay were included there were 19,594 students and 4,522 members of staff (academic and non-academic).

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 postgraduate 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 (e.g. the School of Chemistry, the School of Mathematics, etc.). 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 are 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 advise the Chairman of the Faculty you wish to attend, as different faculties have their own rules for the conduct of open meetings.

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 programmes; 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 Schools in which you will be studying, according to the following list:

Identifying Number	School, Faculty or Department
1	School of Physics
2	School of Chemistry
3	School of Chemical Engineering
4	School of Metallurgy
5	School of Mechanical and Industrial Engineering
6	School of Electrical Engineering
7	School of Mining Engineering
8	School of Civil Engineering
9	School of Wool and Pastoral Sciences
10	School of Mathematics
11	School of Architecture
12	School of Psychology
13	School of Textile Technology
14	School of Accountancy
15	School of Economics
16	School of Health Administration
17	Biological Sciences
18	Department of Industrial Engineering
19	School of Transportation and Traffic
20	School of Highway Engineering
21	Department of Industrial Arts
22	School of Chemical Technology
23	School of Nuclear Engineering
25	School of Applied Geology
26	Department of General Studies
27	School of Geography
28	School of Marketing
29	School of Surveying
31	School of Applied Physics and Optometry
33	Graduate School of Business
35	School of Building
36	School of Town Planning
41	School of Biochemistry
42	School of Biological Technology
43	School of Botany
44	School of Microbiology
45	School of Zoology
50	School of English
51	School of History
52	School of Philosophy
53	School of Sociology
54	School of Political Science
55	School of Librarianship
56	School of French
57	School of Drama
58	School of Education
59	School of Russian
62	School of History and Philosophy of Science
63	School of Social Work
64	School of German
65	School of Spanish and Latin American Studies
66	University of Sydney subjects
69	Centre for Medical Education, Research and Development
70	School of Anatomy
71	School of Medicine
72	School of Pathology
73	School of Physiology and Pharmacology
74	School of Surgery
75	School of Obstetrics and Gynaecology
76	School of Paediatrics
77	School of Psychiatry
79	School of Community Medicine
80	Faculty of Medicine
85	National Postgraduate School of Management Education
90	School of Law
97	Division of Postgraduate Extension Studies

In Section D of the Calendar a short syllabus is given for each subject.

Student Services and Activities

The Library The University Library is on the upper campus and adjacent to the Chancellery and the Sciences, Arts and Commerce Buildings. It contains about 650,000 books and subscribes to more than 18,000 periodicals.

Students may borrow books by presenting a current Union card and the books at the Circulation Desk. 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.

The Bio-Medical Library is located in the Biological Sciences Building. The Law Library is on the 4th Floor of the Sciences Building. A Physical Sciences Library is being developed at present in the main Library building.

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. It is anticipated that the fees in most colleges will be increased for 1975. In addition, assistance is 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. Board and residence fees, which are payable on a session basis, amount to slightly more than $30 per week. Apply in writing to the Master, P.O. Box 24, Kensington, N.S.W. 2033.

International House International House accommodates over 120 students from Australia and twenty other countries. Preference is given to more senior undergraduates and postgraduate students. Fees in 1974 were $28 per week. Apply in writing to the Warden, International House, P.O. Box 88, Kensington, N.S.W. 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. Fees in 1974 were $31 for undergraduates and $32 for postgraduate students. Fees may change in 1975. Enquiries should be addressed to the Master, New College, Anzac Parade, Kensington, N.S.W. 2033.

Shalom College Shalom College provides accommodation for 86 men and women students. The basic fee for residence in 1975 is $38 per week. 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, P.O. Box 1, Kensington, N.S.W. 2033.

Warrane College An affiliated Roman Catholic residential college, Warrane provides accommodation for 200 men students, both post-graduate and undergraduate. Basic fees in 1974 were $30.50 per week for board and residence, payable on a session basis. Apply in writing to the Master, Warrane College, P.O. Box 123, Kensington, N.S.W. 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 programme 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 postgraduate scholarships is also available.

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

Telephone 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 a.m. and 5 p.m. Monday to Friday, and 6 p.m.-9 p.m. on Tuesdays and Thursdays. Telephone extension 2679 or 3275.

Student Counselling and Research Unit The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, undergraduate and postgraduate. 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.

Confidential appointments are made by dropping in to the counselling unit (Huts B and I at the foot of Basser Steps) or by telephoning extensions 2600-2605 between 9.00 a.m. and 5.00 p.m. Evening appointments are also available.

Student Amenities and Recreation Unit 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 programme 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 Inquiry 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, 3261; 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 programme for both students and staff. If you would like to take part in any of the programmes 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 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 and conducts courses in many facets of the arts including weaving, photography, creative dance and yoga.

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:

(a) 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.

(b) A casual employment service.

(c) Organization of Orientation Week.

(d) Organization of Foundation Day.

(e) A nursery/kindergarten, "The House at Pooh Corner".

(f) Publication of the student paper "Tharunka".

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.

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 $4.00.

Details of sporting facilities are available in "Action 75", 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.

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.

The University Chapel is in Hut F near the Chemistry Building, where full-time chaplains are also located. They may be contacted by phone at the following extensions: Anglican, 2684; Jewish, 3273; Roman Catholic, 2379; Churches of Christ, Methodist and Seventh Day Adventist, 2683.

University Co-operative Bookshop Limited Membership is open to all students, on payment of a fee of $5.00, 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 a.m. to 1.00 p.m. and from 2.00 p.m. to 4.30 p.m., Monday to Friday. It is open for additional periods during the first four weeks 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 663 0351, extn. 2406.

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

Air Force Squadron: The N.S.W. University Squadron has ceased to exist but students interested in the Royal Australian Air Force may apply for information to The Commanding Officer, N.S.W. Air Training Corps, 7 Hickson Road, Millers Point, N.S.W. 2000. Telephone 27 5412.

Financial Assistance to Students

Tertiary Education Assistance Scheme

The Tertiary Allowance Scheme, first introduced in 1974, has been renamed the Tertiary Education Assistance Scheme. Under this scheme assistance is available as follows:

- for full-time study in approved courses
- subject to a means test
- on a non-competitive basis
- without restriction
- to students who are not bonded
- to students who are permanent residents of Australia.

The following types of university courses will be eligible for assistance:

- Undergraduate and postgraduate degree courses
- Postgraduate 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 $6,300 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 $6,300 p.a. the amount of living allowance will be reduced by $2 for every $10 of income until the family income exceeds $12,600 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 p.a.

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 $8 per week for a dependent spouse and $5 per week for each child.

How To Apply

Two different forms are used:

1 1974 Higher School Certificate candidates will be sent forms in early January. Applications should be made immediately after enrolment.

2 All other students should apply by 31st October. Forms will be sent in September to students who have been receiving an allowance. Other students may obtain forms from the Admissions Section or the Student Employment and Scholarships Unit, or from the Regional Director, N.S.W. State Office, Department of Education, Central Square, 323 Castlereagh Street, Sydney, N.S.W. 2000 (Telephone 2 0929).

Scholarships, Cadetships

1 *Undergraduate Scholarships* In addition to finance provided under the Australian Government's Tertiary Education Assistance Scheme there are a number of scholarships, cadetships and other forms of assistance available to undergraduate students.
Details of procedures for application for these awards are contained in the University Calendar.
Further information and advice regarding scholarships is available from the Student Employment and Scholarships Unit in the Chancellery Building.

2 *Postgraduate Awards* An honours degree is generally an essential requirement for gaining one of the many postgraduate 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 postgraduate awards are contained in the University Calendar.

Other Financial Assistance

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

(a) The Students' Union and the University have co-operated to provide assistance to students who are in financial difficulties which are considered likely to prejudice their studies.

Three main 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.

In exceptional circumstances the University may consider granting deferments for up to twelve months or even longer. In cases where payment is deferred to 31st December, examination results will not be published or made available until such time as the outstanding fees are paid. Where deferments are granted to a date beyond 31st December, the University may require the student to enter into a formal agreement to repay the fees.

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 *Long Term Cash Loans* An amount of up to $300 is available from this fund. Repayments must be started not later than twelve months after graduation or upon withdrawal from the course. This scheme is funded jointly by the University and the Students' Union. Students are required to enter into a formal agreement with the University to repay such a loan.

(b) 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 twelve months 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 of funds as mentioned in the preceding paragraph students who are in extremely difficult financial circumstances may apply for assistance by way of non-repayable grant. In order to qualify for a grant a student must generally show that the financial difficulty has arisen from misfortune beyond his control.

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

Applications may be made personally to the Deputy Registrar (Student Services), Room 148A, 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 enquiries relating to this scheme should be directed to the Deputy Registrar (Student Services), Room 148A, 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 University Calendar.

When and where do I enrol? To effect formal enrolment it is necessary to present a duly completed and authorized enrolment form to the University cashier together with, where payable, either the appropriate fees, or an authority authorizing those fees to be charged to some other person or institution.

All students are required to attend the appropriate enrolment centre during the prescribed enrolment period for authorization of course programme. Failure to do so will incur a fee of $10. These enrolment centres and the times are listed in a leaflet called "Enrolment Procedures" which is available from the Admissions Office.

Fees should be paid during the prescribed enrolment period but will be accepted during the first two weeks of Session 1 (for late fees see below). No student is regarded as having completed enrolment until fees have been paid. Fees will not be accepted (i.e. enrolment cannot be completed) from new students in year-long courses after 14th March, 1975, and after 31st March from students who are re-enrolling, except with the express approval of the Registrar, which will be given in exceptional circumstances only.

Students enrolling for the first time in any year at the commencement of Session 2 for Session 2 courses only are required to pay all fees due within the first two weeks of that Session. Students' Activities fees payable will be half of the annual fees.

Medical Students

Although the structure of the academic year in the later years of the course in Medicine differs from that followed in other courses, medical students are required to observe the same dates for payment as apply to students in other courses.

How do assisted students (e.g. 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. If this voucher or letter is not available when enrolling they should complete their enrolment paying their own fees. A refund of fees will be made when the enrolment voucher or letter of authority is subsequently lodged with the Cashier.

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.

Your application must give year or stage, whether full-time or part-time, and the course in which you wish to enrol. State clearly and fully the reasons why payment cannot be made and the extension is sought and lodge your application before the date on which a late fee becomes payable. Normally the maximum extension of time for the payment of fees is one month for fees due in Session 1 and one month from the date on which a late fee becomes payable in Session 2.

If an extension of time is granted to a first year student in Session 1 the student may only attend classes on the written authority of the Registrar. This authority will not normally be given in relation to any course where enrolments are restricted.

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.

You will not be eligible to attend the annual examinations in any subject if any portion of your fees for the year is outstanding after the end of the fourth week of Session 2 (15th August, 1975).

In very special cases the Registrar may grant exemption from disqualifications referred to in the two preceding paragraphs 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 17th 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 programme? If you wish to seek approval to substitute one subject for another, add one or more subjects to your programme or discontinue part or all of your programme, 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 31st March.

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: one calendar month from the beginning 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 17th January of the same year that 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 the end of 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. They apply to all students other than those enrolled in programmes leading to a higher degree or diploma. It should be noted that these rules are independent of one another in that a student may infringe more than one rule simultaneously. A subject is defined as a unit of instruction identified by a distinctive subject number. At present the Appeal Committee referred to in Rule 8 consists of a Pro-Vice-Chancellor (Chairman), the Chairman of the Professorial Board, and the Member of Council elected by the graduates of the University. The Pro-Vice-Chancellor is Professor J. B. Thornton.

First-year Rule

1 i A student enrolled in the first year or first stage of any course, other than course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he fails more than half the subjects in that year or stage.

ii A student enrolled in the first year of course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he fails more than two subjects in that year.

iii The provisions of paragraphs (i) and (ii) shall be deemed to apply to a student enrolled in the second or later year or the second or later stage of any course who has transferred from another course or institution and who, in the first year of enrolment immediately following transfer, is enrolled in subjects so chosen that half or more are listed in the current University Calendar as first-year subjects.

Repeated-failure Rule

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

Time Rule—Completion of Years or Stages

3 i A full-time student in either course 340, the Arts (BA) degree course, or 403, the Social Work (BSW) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete eight one-session subjects (or the equivalent) by the end of his second year of attendance.

ii Unless the provisions of paragraph (i) apply, a full-time student shall be required to show cause why he should be allowed to continue a course if he is unable to complete all subjects in the first year of the course by the end of his second year of attendance.

iii A student in course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete all subjects in the second year of the course by the end of his third year of attendance and the third year by the end of his fourth year.

iv A part-time student in course 397, the Science (BSc) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete eight level-one units, including two in mathematics, by the end of his fourth year of attendance and fourteen units, including at least three at level two, by the end of his seventh year.

v Unless the provisions of paragraph (iv) apply, a part-time student shall be required to show cause why he should be allowed to continue a course if he is unable to complete all subjects in the first two stages of the course by the end of his fourth year of attendance and the third and fourth stages by the end of his seventh year.

Time Rule—Completion of Course

4 A student shall be required to show cause why he should be allowed to continue a course which he is unable to complete in the time set down in the following schedule:

Number of years in course	Total years allowed from first enrolment to completion
3	5
4	6

5	8
6	9
7	11
8	12
9	14

Continuation Rule

5 i A student enrolled in a course who has transferred with a record of failure from another tertiary institution shall be required to show cause why he should be allowed to continue the course if he fails more than half the subjects in his first year of enrolment immediately following transfer.

ii A student excluded from a course under the provisions of the Rules who has subsequently been allowed to re-enrol in that course or to transfer to another course shall show cause why he should be allowed to continue the course if he fails one or more subjects in his first year of re-enrolment or transfer.

General Exclusion Rule

6 The Vice-Chancellor may, on the recommendation of the Re-enrolment Committee of the Professorial Board, exclude from a course or courses any student who has been excluded from any other course under the provisions of the Rules and whose record at the University demonstrates the student's lack of fitness to pursue such course or courses.

'Showing Cause'

7 i 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 should be lodged with the Registrar.

ii Any such application shall be considered by the Re-enrolment Committee which shall determine whether the cause shown is adequate to justify the student's being allowed to re-enrol.

Appeal

8 i 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 the Appeal Committee constituted by Council for this purpose. The decision of the Appeal Committee shall be final. In lodging such appeal with the Registrar the student should ensure that a complete statement is furnished of all grounds on which the appeal is based.

ii The notification to any student of a decision by the Re-enrolment Committee to exclude him from re-enrolling in a course and/or subject(s) shall indicate that the student may appeal against that decision to the Appeal Committee.

iii The Appeal Committee shall determine the appeal after consideration of the student's academic record and the stated grounds. In exceptional circumstances the Appeal Committee may require the student to appear in person.

Exclusion

9 i A student who is required to 'show cause' under the provisions of Rule 1 and either does not attempt to 'show cause' or whose application for special permission to re-enrol does not satisfy the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the subject(s) and course on account of which he was required to 'show cause'. Where the subjects are a prescribed part of any other course (or courses) he shall not be allowed to enrol in that course (or courses).

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

iii A student who is required to 'show cause' under one or more of Rules 3-5 and either does not attempt to 'show cause' or whose application for special permission to re-enrol does not satisfy the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the course on account of which he was required to 'show cause'.

iv A student excluded from a course under the provisions of any one or more of paragraphs (i)-(iii) may not enrol in miscellaneous subjects unless he has received the approval of the Admissions Committee of the Professorial Board.

Re-admission after Exclusion

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

ii An excluded student who intends applying for re-admission at a future date may seek advice as to ways in which he may enhance his prospects of re-admission. Such enquiries should be made on the form available from the Examinations and Student Records Section and should be lodged with the Registrar.

iii 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 31st August in the year prior to that for which re-admission is sought. A late application will only be accepted at the discretion of the University.

iv An application should include:

(a) evidence of appropriate study in the subject(s) (or the equivalent) on account of which the applicant was excluded, and

(b) 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.

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 12th September, in a student's final year. 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 programme, must be submitted in writing to the Registrar no later than 30th January.

Fees*

Do I have to pay fees for tuition? No. On 1st January, 1974, fees for tuition were abolished. Other fees and charges remain 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. Late fees are charged where a student fails to observe required procedures by the appropriate time. 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 and 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 undergraduate students and students taking miscel-

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

laneous subjects (with the exception of External Students) will be required to pay:

University Union†—$20 entrance fee

Student Activities Fees

University Union†—$30 annual subscription
Sports Association†—$4 annual subscription
Students' Union†

Students enrolling in full-time courses—$10 annual subscription
Students enrolling in part-time courses—$8 annual subscription

Miscellaneous—$17 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.)

Where applicable, students will also be required to pay $10 for the Pathology Instrument Kit, refundable on return in satisfactory condition.

The Deputy Registrar (Student Services) may, on application, waive student fees for students who, while enrolled in a degree or diploma course at another University in New South Wales, are given approval to enrol at the University of New South Wales in miscellaneous subjects which will be acceptable for credit towards the degrees or diplomas for which they are enrolled.

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

† Life members of these bodies are exempt from the appropriate fee or fees.

What penalties exist for late payment of fees? The following additional charges will be made **in 1975** when fees are paid late:

Session 1—First Enrolments

Fees paid on the late enrolment date, 28th February or later but before 3rd March	$10
Fees paid between 3rd and 14th March	$20
Fees paid after 14th March with the express approval of the Deputy Registrar (Student Services) and Head of the School concerned	$40

Session 1—Re-enrolments

Failure to attend enrolment centre during enrolment week 24th to 28th February	$10
Fees paid between 17th and 31st March	$20
Fees paid after 31st March where accepted with the express approval of the Deputy Registrar (Student Services)	$40

Session 2—All Enrolments

Fees paid between 4th and 11th August	$20
Fees paid thereafter	$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 a refund of all fees paid will be made. After that time only a partial refund will be made.

Examinations

When are examinations held? Most annual examinations are held in November-December but examinations in many subjects are also held during the mid-year 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 Wallace Wurth Medical School, Biological Sciences Building, the Chancellery, Central Lecture Block, Dalton Building (Chemistry), Main Building (Mining and Physics), outside the Sciences Building and in the Western Grounds Area on 6th May and 23rd September. You must advise the Examinations Unit (Chancellery) of a clash in examinations by 19th May and 3rd October. Final timetables are displayed and individual copies are available for students on 3rd June and 21st 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 pre-requisite. 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 30th November) or to your vacation address (fill in a form obtainable at the Enquiry Desk, Chancellery, also by 30th November). Results are also posted on School noticeboards 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, 1974	Friday, 10th January, 1975
Deferred examinations held in January/February, 1975	Tuesday, 25th February, 1975
Annual examinations held in November/December, 1975	Friday, 9th January, 1976
Deferred examinations held in January/February, 1976	Tuesday, 24th February, 1976

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 *at an examination* 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, 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.

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.

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 Section A of the University 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 Enquiry 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, beyond prohibiting gambling on the campus and smoking during lectures, at examinations or in the library.

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 conduct yourself at all times in a seemly fashion.

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 programme 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 at the University Union Enquiry Desk as soon as possible after fee payment. In the meantime, the fees receipt form should be carried during attendance at the University and shown on request. A period of at least three weeks should be allowed to elapse after payment of fees before making application for the card. Cards will not be posted under any circumstances.

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 not reaching you. The University cannot accept responsibility if official communications fail to reach students who have not notified their change of address. A Change of Address Advice Form is available at Faculty and School offices and at the Enquiry Counters on the Ground Floor of the Chancellery Building.

How are student records kept up to date? All students will receive enrolment details forms by 29th April and 1st September. It is not necessary to return these forms unless any information recorded thereon is incorrect. Amended forms must be returned to the Examinations and Student Records Section by 13th May and 15th September respectively. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Where a late amendment is accepted, a late fee of $8 will be payable. 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); higher degree students (limited issue, annual fee $7.80);

postgraduate, and senior undergraduate students who have completed three years of a full-time or part-time course (annual fee $3.90). A permit will allow access to the campus between 5 p.m. and 11 p.m. 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.

Lost Property? All enquiries concerning lost property should be made to the Superintendent on extension 2503 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, scholarships 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 a.m. to 1 p.m. and 2 p.m. to 5 p.m. 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.

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".

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 text and principal reference books. *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. 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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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 programmes 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 Heavy Structures 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.

SCHOOL OF ELECTRICAL ENGINEERING

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

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

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

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

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

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

Formal postgraduate 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 choice 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 SURVEYING

The School of Surveying offers a Bachelor of Surveying degree taken over four years of full-time study or seven years of part-time study. Subject to the approval of the Head of School, combinations of full and part-time study are also permissible. The part-time course is at present being phased out and replaced by a seven-year 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 programmable 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 HIGHWAY ENGINEERING

Postgraduate 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 360/50 computer.

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 postgraduate level in the Faculty of Engineering. A fourth year undergraduate course in Nuclear Power Technology is provided as an elective for other Schools (23.051 Nuclear Power Technology).

In addition to the supervision of programmes 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 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 the University Union Roundhouse. 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 a.m. to 4 p.m. (closed 12 noon to 2 p.m.) from Wednesday 8th January to 10th January, 1975. Telephone 663-0351, extension 2218. Prospective students are advised to take advantage of this facility.

FACULTY ENROLMENT

Preliminary Enrolment 1975

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.

Course in Surveying

Students will receive enrolment instructions by mail.

Course in Civil Engineering

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

Each student should have obtained the Elective/General Studies Preference Form from the School Office. Any student who has not obtained this form should do so and return it completed to the Office by 31st October 1974.

By the end of Session 2 students must obtain their personal Enrolment Form, the Proposed Programme Form EE75, information sheet and timetable from the School Office. After results are notified, the Proposed Programme Form and Enrolment Form (completed as far as possible) should be forwarded to the School Office by Friday 17th January. Completion of enrolment takes place in February with attendance at the enrolment centre.

Enrolment Timetable 1975

School of Civil Engineering

a. Full-time Courses

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

Year 2	Friday 21st February
Surnames A to M	9.00 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 1.00 p.m.
Year 3	Thursday 20th February
Surnames A to M	9.00 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 1.00 p.m.
Year 4	Wednesday 19th February
Surnames A to M	9.00 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 1.00 p.m.

2. *Students with "broken" programmes NOT progressing into a complete year, as shown in the Handbook*

Year 2	Thursday 27th February
Surnames A to M	9.30 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 12.30 p.m.
Year 3	Wednesday 26th February
Surnames A to M	9.30 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 12.30 p.m.
Year 4	Tuesday 25th February
Surnames A to M	9.30 a.m. to 11.00 a.m.
Surnames N to Z	11.00 a.m. to 12.30 p.m.

b. Part-time Courses

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

Stages 2, 3 and 4	Thursday 20th February 6.00 p.m. to 8.00 p.m.
Stages 5 and 6	Friday 21st February 6.00 p.m. to 8.00 p.m.

2. *Students with "broken" programmes NOT progressing into a complete stage as shown in the Handbook*

Stages 2, 3 and 4	Wednesday 26th February 2.00 p.m. to 4.30 p.m. 6.00 p.m. to 8.00 p.m.
Stages 5 and 6	Thursday 27th February 2.00 p.m. to 4.30 p.m. 6.00 p.m. to 8.00 p.m.

c. New Students with Advanced Standing

Full-time	Friday 28th February 9.30 a.m. to 12.30 p.m.
Part-time	Wednesday 26th February 6.00 p.m. to 8.00 p.m.

Civil Engineering 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" programmes 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

Students should attend the appropriate enrolment centre according to the timetable below to pick up their Enrolment Form and enrol in the approved programme.

a. Full-time Courses

Year 1 repeats and Year 2 Students	Thursday 27th February 2.00 p.m. to 4.30 p.m.
Year 3	Tuesday 25th February 2.00 p.m. to 4.30 p.m.
Year 4	Monday 24th February 9.30 a.m. to 12.30 p.m.

b. Part-time Courses

Students re-enrolling at all stages	Wednesday 26th February 6.00 p.m. to 8.00 p.m.

c. New Students with Advanced Standing

Friday 28th February
9.30 a.m. to 12.30 p.m.

Electrical Engineering 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

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:

a. Full-time Courses

Year 2 and Year 1 repeats	Monday 24th February 2.00 p.m. to 6.00 p.m.
Year 3	Tuesday 25th February 9.00 a.m. to 12 noon
Year 4	Monday 24th February 9.00 a.m. to 12 noon

b. Part-time Courses

Stages 2, 3 and Stage 1 repeats	Monday 24th February 2.00 p.m. to 6.00 p.m.
Stages 4, 5, and 6	Tuesday 25th February 2.00 p.m. to 5.00 p.m. 6.00 p.m. to 8.30 p.m.

c. New Students with Advanced Standing

Friday 28th February
2.00 p.m. to 5.00 p.m.

Mechanical and Industrial Engineering Enrolment Centre
Room 106
School of Mechanical and Industrial Engineering Building

School of Surveying

a. Full-time Courses

Year 2	Monday 24th February 9.30 a.m. to 12.30 p.m.
Year 3	Tuesday 25th February 9.30 a.m. to 12.30 p.m.
Year 4	Friday 28th February 9.30 a.m. to 12.30 p.m.

b. Part-time Courses

Students re-enrolling at all Stages	Wednesday 26th February 2.00 p.m. to 6.00 p.m.

c. New Students with Advanced Standing

Full-time	Tuesday 25th February 9.30 a.m. to 12.30 p.m.
Part-time	Wednesday 26th February 2.00 p.m. to 6.00 p.m.

Surveying Enrolment Centre

Full-time	Part-time
Unisearch House	Room 701
221 Anzac Parade	Civil Engineering Building
(across from Main Campus)	

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. See under FEES for the fees applicable.

Students seeking to enrol in miscellaneous subjects should obtain a letter of approval from the Head of the appropriate School or his representative permitting them to enrol in the subject concerned. The letter should be given to the enrolling officer at the time of enrolment. **Where a student is under exclusion he may not be enrolled in any miscellaneous subjects unless given prior approval by the Professorial Board.**

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

Friday 28th February
9.30 a.m. to 12.30 p.m.

School of Electrical Engineering

Persons who wish to obtain a letter of approval to enrol as *Miscellaneous Students in postgraduate subjects in the School of Electrical Engineering* are required to attend Room G3, School of Electrical Engineering, on Friday 21st February, 2.00 p.m. to 5.00 p.m. and 6.00 p.m. to 8.00 p.m.

School of Civil Engineering

Students who wish to obtain a letter of approval to enrol as *Miscellaneous Students in postgraduate subjects in the School of Civil Engineering* are required to attend Room 109, School of Civil Engineering, on Friday 21st February, 2.00 p.m. to 5.00 p.m. and 6.00 p.m. to 8.00 p.m.

Students who wish to obtain a letter of approval to enter as *Miscellaneous Students in undergraduate subjects* should attend the School Office on Friday 28th February, 9.30 a.m. to 12.30 p.m.

Completion of Enrolment

Enrolment is completed by presenting to the cashier a duly authorized enrolment form together with such fees (or authority to charge) as may be payable.

Unless otherwise instructed, students are required to attend for enrolment during ENROLMENT WEEK, 24th February to 28th February, at the times and places specified. Failure to attend involves a charge of $10.

Re-enrolling students may pay fees during the first and second weeks of session (3rd to 14th March) without additional charge. Re-enrolling students who pay fees during the third and fourth weeks of session (17th to 28th March) will incur a charge of $20, unless an extension of time to enrol has been granted.

Enrolments cannot be completed by re-enrolling students after 28th March without the approval of the Deputy Registrar (Student Services). If approval is granted a charge of $40 will be made.

LOCATION OF LABORATORIES OUTSIDE KENSINGTON CAMPUS

Randwick

The Schools of Highway and Traffic Engineering 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 permanent Executive Director, and volunteer local committees made up of interested students at each university. As 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, P.O. 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.

ENGINEERING SCHOLARSHIPS

The Fell Scholarship (University Residential Colleges)

The Fell Scholarship is available to any undergraduate who is or will be in residence at one of the Colleges under the administration of Kensington Colleges Ltd. during the year of the award. The annual value of the Scholarship is $100. It may be held concurrently with other scholarships.

In awarding the scholarship the academic merit and financial need of the applicant will be taken into consideration.

Applications must be made on the appropriate form and lodged with the Master, Kensington Colleges Ltd., Box 24, P.O., Kensington 2033 (Telephone 633-0651).

Joint Coal Board Scholarships

The Joint Coal Board is offering scholarships to male students in full-time courses in Mining Engineering and Applied Geology. While scholarship holders are not under bond, it is expected that they will obtain employment in coal mining or a related industry on graduation. Applications on forms obtainable from principals or from the Secretary, Joint Coal Board, Box 3842, G.P.O., Sydney, must be lodged with the Board's secretary not later than seven days after the notification of the Higher School Certificate results.

The Tyree Electrical Company Scholarship in Electrical Engineering

The Tyree Electrical Company Pty. Ltd., has undertaken to provide scholarships for students enrolling in the full-time courses in Electrical Engineering. The value of the scholarships is between $500 and $1,500 per annum, payable in fortnightly instalments as a living allowance to students. They will normally be tenable for four years but may be extended to a fifth year when the holder intends to qualify for the two degrees, Bachelor of Science and Bachelor of Engineering. They may be held concurrently with any other scholarship.

The Fox Memorial Manufacturing Company Scholarship

The Company offers annually a scholarship to students in the first and later years of the full-time course in Mechanical Engineering.

Regent Scholarship in Engineering for Women Undergraduates

Mrs. G. O'Riordan and Mrs. J. Kouvelis provide annually a $200 scholarship for a female student enrolled in a full-time engineering course, and is normally tenable for four years. The award of the scholarship is based on the applicant's scholastic merit and financial need.

Institution of Surveyors N.S.W. Division Scholarship in Surveying

The Institution of Surveyors N.S.W. Division provides two annual scholarships in Surveying. Tenable in Parts 4, 5, 6 and 8 of the full-time BSurv course, each scholarship provides a living allowance of up to $250 per Part.

PRIZES

School/Department	*Donor/Name of Prize*	*Value*	*Awarded for*
General	Sydney Technical College Union Award	$ 50.00	Leadership in the development of student affairs and academic proficiency throughout the course.
	University of New South Wales Alumni Association	Statuette	Achievement for community benefit – students in their final or graduating year.
Faculty of Engineering	The Dean's Faculty Hour	25.00	Best essay on a topic discussed in Faculty Hour, Faculty of Engineering, by a graduating student.
	The Dean's Faculty Hour	25.00	Best essay on a topic discussed in Faculty Hour, Faculty of Engineering, by a non-graduating student.
School of Chemistry	Australian Chemical Holdings Ltd.	21.00	2.001 Chemistry I.
	George Wright	10.50	Subject selected by Head of School.
School of Civil Engineering	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	Harbin Polytechnical Alumni Association	50.00	Subject selected by Head of School.
	The Association of Consulting Structural Engineers of New South Wales	(1) 20.00 and books to the value of 30.00	General proficiency – Structures in the Bachelor of Engineering Course in Civil Engineering.
		(2) 20.00 and books to the value of 30.00	General proficiency – Structures in the Bachelor of Science (Engineering) Course in Civil Engineering.
	Water Board Gold Medal	Medal	Public Health Engineering.

PRIZES *(continued)*

School/Department	*Donor/Name of Prize*	*Value*	*Awarded for*
School of Electrical Engineering	Austral Bronze Crane Copper Ltd.	25.00	Bachelor of Engineering in Electrical Engineering Year III.
		25.00	Power or Control elective.
	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	J. Douglas Maclurcan	10.50	Control Systems.
	Standard Telephones & Cables Pty. Ltd.	30.00	Subject selected by Head of School.
	The Wilfred Holmes Memorial Award	100.00	A student eligible to enter the final year of the course and who is deemed to be in necessitous circumstances.
Department of Industrial Engineering	Austral Bronze Crane Copper Ltd.	50.00	Bachelor of Engineering Course in Industrial Engineering, Year III.
	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	Industrial Engineering Prize	25.00	Bachelor of Engineering in Industrial Engineering, Year IV.
	T.R.W. Australia Ltd.	20.00	Bachelor of Science (Engineering) Course in Industrial Engineering, Stage 6.
School of Mathematics	School of Mathematics	25.00	Higher Mathematics I.

PRIZES *(continued)*

School/Department	*Donor/Name of Prize*	*Value*	*Awarded for*
		$	
School of Mechanical Engineering	Babcock & Wilcox Aust. Ltd.	21.00	Subject selected by Head of School.
	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	Vickers Cockatoo Dockyard Pty. Ltd.	4.20	Bachelor of Science (Engineering) Course in Naval Architecture, Stage 5.
	Colonial Sugar Refining Co. Ltd.	30.00	Subject selected by Head of School.
	Ford Motor Co. of Aust. Ltd.	20.00	Subject selected by Head of School.
	Harbin Polytechnical Alumni Association	50.00	5.113 Mechanical Engineering Design.
	Jeremy Hirschhorn	20.00	Theory of Machines.
	Royal Institution of Naval Architects	20.00	Bachelor of Engineering or Bachelor of Science (Engineering) Course in Naval Architecture, final year or stage.
	Staedtler (Pacific) Pty. Ltd.	50.00 (order)	General proficiency in Bachelor of Engineering Course in Mechanical Engineering, Year II.
School of Physics	School Prize for Physics II	40.00	Physics II.
School of Surveying	Board of Surveyors Medal	Medal	Bachelor of Surveying Course, Final Year.

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 Science (Engineering). The School of Surveying offers a full-time and part-time 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 postgraduate 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.

Progression

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

(1) Course programmes will continue to be stated and timetabled by Year or Stage and it cannot be guaranteed that non-standard programmes 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) Before enrolling in any subject a student must have satisfied 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 programme 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 programme, such programme must meet with the approval of the Head of School. A non-standard programme 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 course by overseas engineering institutions.

General Studies Programme

Almost all undergraduates in Faculties other than Arts and Law are required to complete a General Studies programme. Courses (in addition to the Faculties of Arts and Law) which do not have this requirement are Bachelor of Science in Psychology, Bachelor of Science in Economic Geography, Bachelor of Science (Education) and Bachelor of Health Administration. The Department of General Studies publishes its own Handbook which is available free of charge. All details regarding General Studies courses and requirements are contained in it, and students are advised to obtain a copy. All enquiries about General Studies should be made to the General Studies Office, Room G15, Morven Brown Building (663-0351 Extn. 2091).

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 of 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 last two being offered by the School of Mechanical and Industrial Engineering). No new enrolments will be accepted after 1974 in the BSc(Eng) course in Civil Engineering.

The General Studies programme 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 Section C of the University 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 programme 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 will be phased out over the period 1975-1980. It will be replaced by a sandwich course.

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	BSc(Tech)*
Ceramic Engineering	BSc	BSc(Tech)
Metallurgy	BSc	BSc(Tech)
Mining Engineering	BE	BSc(Eng)†
Textile Engineering	BSc	–

* The BSc(Tech) degree course in Chemical Engineering will be discontinued in 1975 and replaced by the BE degree course, taken in seven stages of full/part-time study. Students in the BSc(Tech) course in 1975 will be allowed to complete it.

† 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.

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 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.

Holders of the degrees of BSc in Textile Technology (Textile Engineering course) of BE (pass or honours) and BSc(Tech) 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.

Metallurgy

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 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 postgraduate work for engineering graduates in the School of Metallurgy may be obtained from the University Calendar, 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 programmes 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 University Calendar or the Faculty of Applied Science Handbook.

GRADUATE SCHOOL OF ENGINEERING

HIGHER DEGREES

Research Degrees

The higher degrees of Master of Engineering, Master of Surveying, and of Doctor of Philosophy are awarded on the presentation of a thesis, satisfactory to the examiners, which embodies the results of an original investigation or design. Candidates for these degrees must possess a bachelor's degree in an appropriate field and meet the conditions governing the award of these degrees. The full conditions are set out in the University Calendar and in the Handbook of the Graduate School of Engineering.

The degree of Doctor of Science is also awarded for a contribution of distinguished merit in the field of engineering.

GRADUATE COURSES

Courses of Study for Graduate Awards

In addition to the research degrees listed above, the Faculty offers courses in instruction at the graduate level leading to the award of the degree of Master of Engineering Science, Master of Surveying Science or to a graduate diploma.

Courses for the Degrees of Master of Engineering Science and Master of Surveying Science

These degrees may be gained by –

(i) formal course work;
(ii) a combination of formal course work and the completion of a report on a project or a research thesis; or
(iii) completion of a research thesis.

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 programme of studies best suited to his needs.

Courses for Graduate Diplomas

Highway Engineering, Human Communications, Industrial Engineering and Transport.

Full details of all these courses are given in the section on post-graduate study in the University Calendar, in the Handbooks of the appropriate Schools, and in the Handbook of the Graduate School of Engineering or may be obtained from the Dean of the Faculty of Engineering.

The Faculty of Engineering also supervises the Graduate Diploma course in Human Communications, offered by the Division of Post-graduate Extension Studies.

Special Courses

Short, intensive graduate and special courses are provided throughout each year designed to keep practising engineers in touch with the latest developments in their various fields. The programmes of such courses for this year are published separately.

OUTLINES OF UNDERGRADUATE COURSES

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 programme, comprising the first 6 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 new enrolments will be accepted in the BSc(Eng) course after 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

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.001 / 1.011	Physics I *or* Higher Physics I	3	3	3	3
2.021	Chemistry IE	3	3	0	0
5.010	Engineering A	4	2	0	0
5.020	Engineering B	0	0	4	2
5.030	Engineering C	0	0	4	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	2
		14	10	15	9

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 2					
8.172	Mechanics of Solids II	2	2	0	0
8.181	Structural Design I	1	1½	1	1½
8.272	Civil Engineering Materials I	1½	2½	1½	2½
8.301	Systems Engineering	2	2	0	0
8.571	Hydraulics I	0	0	1½	1½
8.671	Engineering Construction	2	1	0	0
10.022	Engineering Mathematics II	2	2	2	2
29.441	Engineering Surveying	0	0	3	3
29.491	Survey Camp†		–		–
	Two Electives*	2	1	2	1
		12½	12	11	11½

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

YEAR 3					
8.001	Industrial Training	0	0	0	0
8.173	Structural Analysis I	2	1	0	0
8.174	Structural Analysis II	0	0	2	1
8.182	Structural Design II	1	2	1	2
8.273	Civil Engineering Materials II	1½	1½	1½	1½
8.351	Engineering Mathematics	2½	2½	0	0
8.572	Hydraulics II	1½	1½	0	0
8.573	Hydrauilcs III	0	0	1½	1½
8.581	Water Resources I	1½	1½	0	0
8.582	Water Resources II	0	0	1½	1½
8.672	Planning and Management I	0	0	2	2
	Two Electives*	2	1	2	1
		12	11	11½	10½

* Of ten required electives at least four are in General Studies, and at least four are technical electives. Two of the General Studies electives are taken prior to Year 4 or Stage 6. 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. In addition to those listed for Year 2, approved technical electives for Year 3 are: 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 Engineering I.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 4					
	Two Engineering Electives†	2	2	2	2
8.153	Structures	3	2	3	2
8.253	Civil Engineering Materials	3	2	3	2
8.532	Water Engineering	1½	1½	1½	1½
8.631	Civil Engineering	3	½	3	½
	Two General Studies Electives*	2	1	2	1
		14½	9	14½	9

* One elective must be advanced; as an alternative to it, students may take the Sociology IIIA (53.113) option "Science, Technology and Society".

† In addition to the technical electives listed for Year 3, approved Year 4 Engineering Electives are: 8.011 Projects, 8.012 Elements of Architecture, 8.013 Bridge Engineering, 8.014 Computer Application 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.

YEAR 4†					
8.191	Structural Engineering	1½	1½	0	0
8.274	Civil Engineering Materials III	1½	1½	1½	1½
8.583	Water Resources III	1	2	0	0
8.673	Planning and Management II	1	2	1	2
8.051	Design Projects I	0	0	0	2½
8.052	Design Projects II	0	0	0	2½
	Six Electives*	4½	4½	4½	4½
		9½	11½	7	13

† Available in 1976 for the first time.

* For electives, see footnotes following Years 3 & 4 above.

363. CIVIL ENGINEERING – PART-TIME COURSE

Bachelor of Science (Engineering)

STAGE 1					
1.001 / 1.011	Physics I *or* Higher Physics I	3	3	3	3
10.001 / 10.011	Mathematics I *or* Higher Mathematics*	4	2	4	2
		7	5	7	5

* Not available in the evening in 1975.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 2					
2.021	Chemistry IE	3	3	0	0
5.010	Engineering A	4	2	0	0
5.020	Engineering B	0	0	4	2
5.030	Engineering C	0	0	4	2
	One Elective*	1	½	1	½
		8	5½	9	4½

* The part-time programme is being revised. See * footnote following Year 3 above.

STAGE 3					
8.172	Mechanics of Solids II	0	0	2	2
8.272	Civil Engineering Materials I	1½	2½	1½	2½
10.022	Engineering Mathematics II	2	2	2	2
29.441	Engineering Surveying*	3	3	0	0
29.491	Survey Camp†		–		–
		6½	7½	5½	6½

* 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	1	1½	1	1½
8.273	Civil Engineering II	1½	1½	1½	1½
8.301	Systems Engineering	0	0	2	2
8.571	Hydraulics I	1½	1½	0	0
8.671	Engineering Construction	0	0	2	1
	One Elective*	2	1	0	0
		6	5½	6½	6

* The part-time programme is being revised. See * footnote following Year 3.

STAGE 5					
8.152	Structures	3	1	3	1
8.161	Engineering Mathematics	1¼	1¼	1¼	1¼
8.301	Systems Engineering	1	1	1	1
8.531	Water Engineering	2½	1½	2½	1½
		7¾	4¾	7¾	4¾

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 6					
8.154	Structures	2	2	2	2
8.252	Civil Engineering Materials	3	1	0	0
8.254	Civil Engineering Materials	0	0	2	4
8.632	Civil Engineering	1½	0	1½	0
	General Studies Elective	1	½	1	½
		7½	3½	6½	6½
STAGE 5*					
8.173	Structural Analysis I	0	0	2	1
8.182	Structural Design II	1	2	1	2
8.351	Engineering Mathematics	0	0	2½	2½
8.572	Hydraulics II	0	0	1½	1½
8.672	Planning & Management I	2	2	0	0
	Two Electives	4	2	0	0
		7	6	7	7

* Available in 1976 for the first time.

STAGE 6*					
8.174	Structural Analysis II	2	1	0	0
8.191	Structural Engineering	0	0	1½	1½
8.274	Civil Engineering Materials III	1½	1½	1½	1½
8.573	Hydraulics III	1½	1½	0	0
8.581	Water Resources I	0	0	1½	1½
8.582	Water Resources II	1½	1½	0	0
	Two Electives	1	½	2½	2
		7½	6	7	6½

* Available in 1977 for the first time.

STAGE 7*					
8.001	Industrial Training†	0	0	0	0
8.051	Design Projects I	0	2½	0	0
8.052	Design Projects II	0	2½	0	0
8.583	Water Resources III	0	0	1	2
8.673	Planning & Management II	1	2	1	2
	Four Electives	3	3	3	3
		4	10	5	7

* Available in 1978 for the first time.

† See introduction to School of Civil Engineering.

SCHOOL OF ELECTRICAL ENGINEERING

The School consists of the Departments of Communications, Computer Science, Electric Power Engineering, Solid State Electronics and Systems and Control Engineering and offers undergraduate and postgraduate training in all branches of the profession of electrical engineering. The School's teaching and research programmes are constantly under review to meet the ever changing challenges of present and future needs.

The School offers a full-time course of four years' duration leading to the degree of Bachelor of Engineering, and a six-year part-time course for the degree of Bachelor of Science (Engineering). The courses may also be completed by a combination of part-time and full-time study. Graduate courses are described elsewhere.

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, has stated that it is reviewing its requirements for graduates completing their course by 1980.

Electrical engineering, perhaps more than most other branches of engineering, is closely linked with the pure sciences, and requires a scientific outlook and approach for a proper understanding of its problems.

The pattern of undergraduate courses is being changed to a compulsory core of basic sciences and electrical engineering, together with electives in specialized electrical engineering areas and with a further group of electives in other technical and non-technical fields. Approximately one half the program will be elective, subject to the approval of the Head of the School: this new pattern is being introduced progressively and should be largely operational in 1976.

Each student in the BE course is required to work on an individual or group project under the guidance of members of the lecturing staff. Generally, the project will involve the design and construction of experimental apparatus together with laboratory tests. Where possible the projects will be related to the research programme of the School and chosen to develop the student's initiative. Each student is required to lead a seminar and to prepare a thesis or take part in the preparation of a group thesis based on the results of the project work.

All students in the BSc(Eng) course must complete three years of appropriate industrial training (6.902 Industrial Experience). Students should enrol in the subject 6.902 Industrial Experience in the year in which they expect to satisfy the requirement and, upon completion, submit to the School evidence from their employers to such industrial training. Students in the BE degree course are strongly recommended to obtain practical experience in the long vacations.

In the Bachelor of Engineering course the same formal programme 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.

364. ELECTRICAL ENGINEERING – FULL-TIME COURSE

Bachelor of Engineering

The full-time course is of four years' duration and leads to the degree of Bachelor of Engineering (pass or honours).

		Hours per week			
		Session 1		Session 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 1					
1.001	Physics I*	3	3	3	3
5.010	Engineering A	4	2	0	0
6.010	Electrical Engineering I	0	0	2	4
10.001	Mathematics I*	4	2	4	2
	Either				
2.001	Chemistry I	3	3	3	3
	or				
2.021	Chemistry IE	3	3	0	0
5.030	Engineering C	0	0	3	3
		14	10	12	12
YEAR 2					
1.112A	Electromagnetism*	0	0	3	3
1.112C	Waves in Continuous Media & Thermodynamics*	2	0	2	0
4.921	Metallurgy	0	0	1	1
6.021	Electrical Engineering II	3	3	3	3
8.113	Civil Engineering	2	1½	1	½
10.111A	Pure Mathematics II (Linear Algebra)*	1½	½	1½	½
10.111B	Pure Mathematics (Analysis)*	1½	½	1½	½
10.211A	Applied Mathematics II (Mathematical Methods)*	1½	½	1½	½
	One General Studies Subject	1	½	1½	½
	Either				
1.112B	Modern Physics*	3	3	0	0
	or				
6.601A	Introduction to Computing	4	1	0	0
		15½/16½	9½/7½	16	9½

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

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 3					
5.661	Mechanical Engineering III	2	1	2	1
10.033	Electrical Engineering Mathematics III	2	0	2	0
10.361	Statistics SE	1	½	1	½
	Electrical Engineering III				
6.031A	Systems and Circuit Theory	2	2	2	2
6.031B	Energy Conversion, Transmission and Utilization	2	2	2	2
6.031C	Electronic Circuits and Signal Processing	2	2	2	2
6.031D	Computing	0	0	2	2
6.031E	Electron Physics and Devices	3	1	0	0
	Two General Studies Subjects	2	1	2	1
		16	9½	15	10½
YEAR 4					
6.911	Thesis				
	or				
6.931	Group Thesis *				
	One General Studies Advanced Elective†	0	0	2	1
	Electrical Engineering IV (6 Electives)	8	12	4	6

A number of general topics is offered and each Department offers specialized electives. Not all electives are offered every year: students will be advised each year which electives are available.

Four electives are taken in Session 1 and two in Session 2. Each elective 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 and Design and Reliability
6.202 Power Engineering – Systems I
6.023 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 Software

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

* *Thesis or Group 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 with

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365. ELECTRICAL ENGINEERING – PART-TIME COURSE

Bachelor of Science (Engineering)

The six-year part-time course in Electrical Engineering leads to the degree of Bachelor of Science (Engineering).

		Hours per week for 2 sessions	
		Lec.	Lab. Tut.
STAGE 1			
1.001	Physics I	3	3
10.001	Mathematics I	4	2
		7	5
STAGE 2			
2.001	Chemistry I	3	3
5.010	Engineering A (Session 1)	4	2
6.010	Electrical Engineering I (Session 2)	2	4
		7/5	5/7
STAGE 3			
1.112C	Waves in Continuous Media and Thermodynamics	2	0
6.021	Electrical Engineering II	3	3
10.111A	Pure Mathematics II (Linear Algebra)	1½	½
10.111B	Pure Mathematics II (Analysis)	1½	½
		8	4
STAGE 4			
1.112A	Electromagnetism (Session 2) }	3	3
1.112B	Modern Physics (Session 1) }		
6.031A	Systems and Circuit Theory	2	2
10.211A	Applied Mathematics II (Mathematical Methods)	1½	½
	One General Studies Subject	1	½
		7½	6
STAGE 5			
4.921	Material Science	1	0
6.031B	Energy Conversion, Transmission and Utilization	2	2
6.031C	Electronic Circuits and Signal Processing	2	2
	Two General Studies subjects	2	1
		7	5

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special reading and study associated with the presentation of a seminar and the preparation of a thesis. The thesis must be submitted by the last Monday in November.

† At least one General Studies advanced elective is required in the course.

		Hours per week for 2 sessions	
		Lec.	Lab. Tut.
STAGE 6*†			
6.031D	Computing	1	1
6.043	Measurements	1	1
	Two Professional Electives*	2	3
	Either		
6.031E	Electron Physics and Devices	2	0
	or		
5.661	Mechanical Engineering	2	1
		6	5/6

* The list of electives to be offered will largely correspond to those in Electrical Engineering IV list (see the BE programme). The full range of electives will not be 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 programme. For further details of the requirement see the introduction to School of Electrical Engineering.

ELECTRICAL ENGINEERING – COMBINED FULL-TIME/PART-TIME COURSES

The subjects of the BSc(Eng) course are generally identical with a subject of the BE programme and the requirements of these subjects can be completed by either day or evening study in most cases. Timetables will be arranged to suit the yearly programmes given above. Provided prerequisites are met and the programme 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.

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 programme 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 one or 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 some Computer Science or additional Applied Mathematics in their Second Year Electrical Engineering programme 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. If the BSc programme is completed these courses could be put back into the student's Third Year of Electrical Engineering;

(d) The normal Fourth Year of the BE programme 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 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 years 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 programme followed in their year in Science they will have already completed parts of the normal third year programme of the Electrical Engineering course, and they will be required to omit these from their programme 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.

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.

(i) by initially enrolling as a student proceeding to the double degree, or

(ii) by transferring to the BA BE programme with advanced standing after partially completing the requirements of either degree, provided that suitable courses have been studied.

Any student 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 programme for four years in which he studies at least nine courses in accordance with the regulations of the Faculty of Arts, provided that they include:

(i) the subjects in Table A below, and

(ii) a major sequence of courses available within the Faculty of Arts (see Schedule A of that Faculty's regulations) in addition to his studies in the School of Mathematics.

In addition he shall also study concurrently subjects selected from Table B in accordance with an acceptable programme loading.

To complete his studies he must satisfy the requirements of a normal BE programme in Electrical Engineering, less

(a) the General Studies subjects, and

(b) the equivalent of ONE non-electrical engineering subject of the BE course, and

(c) either strand B or strand E of Electrical Engineering III, and

(d) one of the six units of Electrical Engineering IV.

Table A

10.001	Mathematics I	*or*	10.011	Higher Mathematics I
10.111A	Pure Mathematics II (Linear Algebra		10.121A	Higher Pure Mathematics II (Algebra)
10.111B	Pure Mathematics II (Analysis)	*or*	10.121B	Higher Pure Mathematics II (Real and Complex Analysis)
10.211A	Applied Mathematics II (Mathematical Methods)		10.221A	Higher Applied Mathematics II (Mathematical Methods)
1.001	Physics I	*or*	1.011	Higher Physics I
1.112	Physics II			

Table B

2.001	Chemistry	*or*	2.021 Chemistry IE
4.921	Metallurgy*		5.030 Engineering C
5.010	Engineering A		
5.661	Mechanical Engineering III*		
6.010	Electrical Engineering I		
6.021	Electrical Engineering II		
6.031	Electrical Engineering III*		
8.113	Civil Engineering*		
10.033	Electrical Engineering Mathematics III		(If these or equivalent units not already selected as an approved subject.)
10.361	Statistics SE		

NOTES:

(i) The substitution rule for the BE in Electrical Engineering if invoked (see Electrical Engineering – Substitution of Subjects) may modify the requirements set out in Table B.

(ii) In addition it may be possible to defer strand B or strand D of 6.031 Electrical Engineering III into the fifth year of the combined programme, provided that the student does not wish to major in the relevant field, i.e. Power Engineering or Computing. Such re-arrangements are to be regarded as special cases and prior approval of the School of Electrical Engineering must be sought and received.

(iii) 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 result of their combined BA BE double degree programme 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.

* Permission may be given for some portion of the subjects marked with an asterisk to be deferred until after the completion of the four year programme.

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.

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 Section B of 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. However, the Institution has stated that it is unlikely to recognize the BSc(Eng) degree in Industrial Engineering after 1980.

368. MECHANICAL ENGINEERING – FULL-TIME COURSE
Bachelor of Engineering

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 1					
1.001 / 1.011	Physics I *or* Higher Physics I	3	3	3	3
2.021	Chemistry IE*	3	3	3	3
5.010	Engineering A*	4	2	4	2
5.020	Engineering B	0	0	4	2
5.030	Engineering C*	4	2	4	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	2

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

YEAR 2					
5.032	Experimental Engineering II	1	1	1	1
5.061	Technical Orientation	½	0	½	0
5.111	Mechanical Engineering Design I	2	2	2	2
5.311	Engineering Mechanics*	1½	1	1½	1
5.611	Fluid Mechanics/Thermodynamics I	2	2	2	2
6.801	Electrical Engineering	1	2	1	2
8.151	Mechanics of Solids	2	1	2	1
8.259	Properties of Materials	2	1	2	1
10.022	Engineering Mathematics II	2	2	2	2
	General Studies Elective	1	½	1	½

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

YEAR 3					
5.033	Experimental Engineering III	1	½	1	½
5.043	Industrial Training I	0	0	0	0
5.071	Engineering Analysis	2½	1	2½	1
5.112	Mechanical Engineering Design II	2	1	2	1
5.331	Dynamics of Machines I	1½	½	1½	½
5.412	Mechanics of Solids I	1½	½	1½	½
5.612	Fluid Mechanics/Thermodynamics II	2½	1	2½	1
6.802	Electrical Engineering*	2	1	2	1
18.011	Industrial Engineering IA *or*	1	1	1½	½
18.021	Industrial Engineering IB	1½	½	1½	½
	General Studies Elective	2	1	2	1

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

		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
YEAR 4					
5.044	Industrial Training II	0	0	0	0
5.051	Thesis	0	6	0	6
5.062	Communications	2	0	2	0
5.324	Automatic Control Engineering	2	1	2	1
	General Studies Elective	1	½	1	½
Plus 12 hours from the following Technical Electives:					
4.913	Materials Science	2	1	2	1
5.113	Mechanical Engineering Design III	1½	4½	1½	4½
5.332	Dynamics of Machines II	2	1	2	1
5.413	Mechanics of Solids II	2	1	2	1
5.613	Fluid Mechanics/Thermodynamics III	4	2	4	2
8.026	Systems Methods in Civil Engineering	2	1	2	1
18.012	Industrial Engineering IIA	2	1	2	1
18.022	Industrial Engineering IIB	2	1	2	1
18.431	Design for Production	2	1	2	1
18.551	Operations Research	2	1	2	1
23.051	Nuclear Power Technology	2	1	2	1

369. MECHANICAL ENGINEERING – PART-TIME COURSE
Bachelor of Science (Engineering)

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

		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
STAGE 1					
1.001 / 1.011	Physics I *or* Higher Physics I	3	3	3	3
10.001 / 10.011	Mathematics I *or* Higher Mathematics I*	4	2	4	2
		7	5	7	5

* Not available in the evening in 1975.

STAGE 2					
2.021	Chemistry IE*	3	3	3	3
5.010	Engineering A*	4	2	4	2
5.020	Engineering B†	0	0	4	2
5.030	Engineering C*	4	2	4	2

* One session only. Students will take this subject in either Session 1 or Session 2.
† Broken Hill students take 5.301 Engineering Mechanics (1–1) in lieu of 5.020.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 3					
5.311	Engineering Mechanics	1	½	1	½
8.151	Mechanics of Solids	2	1	2	1
8.259	Properties of Materials	2	1	2	1
10.022	Engineering Mathematics II	2	2	2	2
	General Studies Elective	1	½	1	½
		8	5	8	5
STAGE 4					
5.032	Experimental Engineering II	1	1	1	1
5.111	Mechanical Engineering Design I	2	1	2	1
5.611	Fluid Mechanics/Thermodynamics I	2	2	2	2
6.801	Electrical Engineering	1	2	1	2
	General Studies Elective	1	½	1	½
		7	6½	7	6½
STAGE 5					
5.071	Engineering Analysis	2½	1	2½	1
5.112	Mechanical Engineering Design II	2	1	2	1
5.331	Dynamics of Machines I	1½	½	1½	½
5.412	Mechanics of Solids I	1½	½	1½	½
5.612	Fluid Mechanics/Thermodynamics II	2½	1	2½	1
		10	4	10	4
STAGE 6					
5.042	Industrial Experience*	0	0	0	0
5.113	Mechanical Engineering Design III	1½	4½	1½	4½
5.324	Automatic Control Engineering	2	1	2	1
	General Studies Elective	1	½	1	½
	Plus 3 hours from Mechanical Engineering Electives:				
4.913	Materials Science	2	1	2	1
5.332	Dynamics of Machines II	2	1	2	1
5.413	Mechanics of Solids II	2	1	2	1

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

361. AERONAUTICAL ENGINEERING – FULL-TIME COURSE

Bachelor of Engineering

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

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 3					
5.033	Experimental Engineering III	1	½	1	½
5.043	Industrial Training I	0	0	0	0
5.071	Engineering Analysis	2½	1	2½	1
5.303	Mechanical Vibrations	1	½	0	0
5.412	Mechanics of Solids I	1½	½	1½	½
5.800	Aircraft Design	0	0	1½	1
5.811	Aerodynamics I	2	1	2	1
5.822	Analysis of Aerospace Structures I	1½	½	1½	½
6.802	Electrical Engineering*	2	1	2	1
18.011	Industrial Engineering IA *or*	1	1	1½	½
18.021	Industrial Engineering IB	1½	½	1½	½
	General Studies Elective	2	1	2	1

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

YEAR 4					
5.044	Industrial Training II	0	0	0	0
5.051	Thesis	0	6	0	6
5.062	Communications	1	1	1	1
5.801	Aircraft Design	2	2	2	2
5.812	Aerodynamics II	2	1	2	1
5.823	Analysis of Aerospace Structures II	1½	½	1½	½
5.831	Aircraft Propulsion	1½	½	1½	½
	General Studies Elective	1	½	1	½
	Plus one technical elective from:				
4.913	Materials Science				
5.324	Automatic Control Engineering				
8.026	Systems Methods in Civil Engineering	2	1	2	1
18.022	Industrial Engineering IIB				
18.551	Operations Research				
		11	12½	11	12½

360. AERONAUTICAL ENGINEERING – PART-TIME COURSE

Bachelor of Science (Engineering)

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.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 5					
5.071	Engineering Analysis	2½	1	2½	1
5.303	Mechanical Vibrations	1	½	0	0
5.412	Mechanics of Solids I	1½	½	1½	½
5.811	Aerodynamics I	2	1	2	1
5.822	Analysis of Aerospace Structures I	1½	½	1½	½
		8½	3½	7½	3
STAGE 6					
5.042	Industrial Experience*	0	0	0	0
5.801	Aircraft Design	2	2	2	2
5.812	Aerodynamics II	2	1	2	1
5.823	Analysis of Aerospace Structures II	1½	½	1½	½
5.831	Aircraft Propulsion	1½	½	1½	½
	General Studies Elective	1	½	1	½
		8	4½	8	4½

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

370. NAVAL ARCHITECTURE – FULL-TIME COURSE

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 full-time programme leading to the Bachelor of Engineering degree in Naval Architecture.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 3					
5.033	Experimental Engineering III	1	½	1	½
5.043	Industrial Training I	0	0	0	0
5.071	Engineering Analysis	2½	1	2½	1
5.303	Mechanical Vibrations	1	½	0	0
5.412	Mechanics of Solids I	1½	½	1½	½
5.911	Naval Architecture	2½	1½	2½	1½
5.921	Ship Structures I	1½	½	1½	½
5.931	Principles of Ship Design IA	1	½	0	0
5.932	Principles of Ship Design IB	0	0	1	½
5.951	Hydrodynamics	1	½	0	0
18.021	Industrial Engineering IB	1½	½	1½	½
	General Studies Elective	2	1	2	1
		15½	7	13½	6
YEAR 4					
5.044	Industrial Training II	0	0	0	0
5.051	Thesis	0	6	0	6
5.062	Communications	2	0	2	0
5.922	Ship Structures II	1½	½	1½	½
5.933	Principles of Ship Design	2	1	2	1
5.934	Ship Design Project	0	3	0	3
5.941	Ship Propulsion and Systems	2½	1½	2½	1½
	General Studies Elective	1	½	1	½
	Plus one elective from:				
4.913	Materials Science				
8.026	Systems Methods in Civil Engineering	2	1	2	1
18.022	Industrial Engineering IIB				
18.551	Operations Research				
		11	13½	11	13½

371. NAVAL ARCHITECTURE – PART-TIME COURSE

Bachelor of Science (Engineering)

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.

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 5					
5.071	Engineering Analysis	2½	1	2½	1
5.303	Mechanical Vibrations	1	½	0	0
5.412	Mechanics of Solids I	1½	½	1½	½
5.911	Naval Architecture	2½	1½	2½	1½
5.921	Ship Structures I	1½	½	1½	½
5.932	Principles of Ship Design IB	0	0	1	½
		9	4	9	4
STAGE 6					
5.042	Industrial Experience*	0	0	0	0
5.922	Ship Structures II	1½	½	1½	½
5.933	Principles of Ship Design II	2	1	2	1
5.934	Ship Design Project	0	3	0	3
5.941	Ship Propulsion and Systems	2½	1½	2½	1½
	General Studies Elective	1	½	1	½
		7	6½	7	6½

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

DEPARTMENT OF INDUSTRIAL ENGINEERING

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

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

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

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

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

The Work of the Industrial Engineer

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

(a) **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.

(b) **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.

(c) **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.

(d) **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.

(e) **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.

366. INDUSTRIAL ENGINEERING – FULL-TIME COURSE

Bachelor of Engineering

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

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 3					
5.033	Experimental Engineering III	1	½	1	½
5.043	Industrial Training I	0	0	0	0
5.071	Engineering Analysis	2½	1	2½	1
5.112	Mechanical Engineering Design II	2	1	2	1
5.331	Dynamics of Machines I	1½	½	1½	½
5.412	Mechanics of Solids I	1½	½	1½	½
14.001	Introduction to Accounting	1½	0	1½	0
18.011	Industrial Engineering IA	1	1	1½	½
18.021	Industrial Engineering IB	1½	½	1½	½
	General Studies Elective	2	1	2	1
		14½	6	15	5½
YEAR 4					
5.044	Industrial Training II	0	0	0	0
5.051	Thesis	0	6	0	6
5.062	Communications	1	1	1	1
5.324	Automatic Control Engineering	2	1	2	1
18.012	Industrial Engineering IIA	2	1	2	1
18.022	Industrial Engineering IIB	2	1	2	1
18.551	Operations Research	2	1	2	1
	General Studies Elective	1	½	1	½
	Plus one elective from:				
4.913	Materials Science				
5.332	Dynamics of Machines II				
5.413	Mechanics of Solids II	2	1	2	1
8.026	Systems Methods in Civil Engineering				
18.431	Design for Production				
		12	12½	12	12½

367. INDUSTRIAL ENGINEERING – PART-TIME COURSE

Bachelor of Science (Engineering)

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

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

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.,	Lab. Tut.
STAGE 5					
5.071	Engineering Analysis	2½	1	2½	1
5.112	Mechanical Engineering Design II	2	1	2	1
5.331	Dynamics of Machines I	1½	½	1½	½
14.001	Introduction to Accounting	1½	0	1½	0
18.011	Industrial Engineering IA	1	1	1½	½
18.021	Industrial Engineering IB	1½	½	1½	½
		10	4	10½	3½
STAGE 6					
5.042	Industrial Experience*	0	0	0	0
18.012	Industrial Engineering IIA	2	1	2	1
18.022	Industrial Engineering IIB	2	1	2	1
18.431	Design for Production	2	1	2	1
18.551	Operations Research	2	1	2	1
	General Studies Elective	1	½	1	½
		9	4½	9	4½

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

SCHOOL OF SURVEYING

The School of Surveying offers a four year full-time course and a seven year part-time course both leading to the degree of Bachelor of Surveying. The degree is divided into eight parts of one session each and can also be attained through a combination of part-time and full-time study. Part 7 comprises professional training and a survey camp.

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. First and second years are concerned mainly with the basic sciences, but the basic surveying subjects are also included. In the third year the major surveying subjects appear: geodesy, photogrammetry, astronomy and land studies. With the addition of some elective courses these are continued into fourth year. 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 full-time and part-time courses have undergone comprehensive revision. 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 six 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.

The existing part-time course will be phased out over the period 1975-1980. It will be replaced by a sandwich course. 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 minimum time for completion of the sandwich course will be seven years, as for the present part-time course. 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.

The transition 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 1975 will have three alternative ways of completing Parts 1 and 2. They can attend full time for one year, take part-time (evening) classes for two years or they can attend Part 1 in Session 1 of 1975 followed by Part 2 in Session 2 of 1976. Thereafter they will follow the standard sandwich course. See diagram below: *Method of Implementation of Revised BSurv Course.*

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.

374. SURVEYING – FULL-TIME COURSE

Bachelor of Surveying

		Hours per week	
		Lec.	Lab. Tut.
YEAR 1 – *Session 1* (PART 1)			
1.001	Physics I	3	3
5.030	Engineering C* (Session 1)	3	2
10.001	Mathematics I	4	2
29.001	Surveying IA	3	2½
		13	9½

* Introduction to Systems and Computers Option.

YEAR 1 – *Session 2* (PART 2)			
1.001	Physics I	3	3
5.010	Engineering A*	4	2
10.001	Mathematics I	4	2
29.002	Surveying IB	1	5½
		12	12½

* 4.901 Materials Option.

		Hours per week Lec.	Lab. Tut.
YEAR 2 – *Session 1* (PART 3)			
10.022	Engineering Mathematics II	2	2
10.341	Statistics	1½	0
29.102	Surveying II	2	4
29.151	Survey Computations I	3½	2½
31.212	Geometrical Optics	1½	1½
		10½	10
YEAR 2 – *Session 2* (PART 4)			
6.822	Electronics	1	2
8.711	Engineering for Surveyors	3	0
10.022	Engineering Mathematics II	2	2
10.341	Statistics	1½	0
29.102	Surveying II	1½	1½
29.192	Survey Camp*	—	—
27.293	Physical Geography for Land Assessment†	2	2
29.161	Hydrographic Surveying I	1	1
	or		
29.182	Cartography Elective	1	1
	General Studies Elective	2	1
		14	9½

* Students are required to attend a two-week survey camp, held in October, 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 Surveyors	3	0
29.211	Geodesy I	4	2
29.311	Astronomy I	2	1
29.612	Land Studies II†	4	1
36.411	Town Planning	1½	1½
	General Studies Elective	2	1
		16½	6½

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

YEAR 3 – *Session 2* (PART 6)			
29.103	Surveying III	4	3
29.152	Survey Computations II	2	1
29.511	Photogrammetry I	3	3
29.613	Land Studies III	2	0
29.614	Land Studies Project	1	2
	General Studies Elective	2	1
		14	10

YEAR 4 – *Session 1* (PART 7)

29.193	Professional Training	5 Months
29.194	Survey Camp*	4 Weeks: Field 2 Weeks: Office

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

		Hours per week	
		Lec.	Lab. Tut.
YEAR 4 – *Session 2* (PART 8)			
8.713	Management for Surveyors	2	0
29.212	Geodesy II	2	1
29.312	Astronomy II	2	1
29.512	Photogrammetry II	1½	1½
	General Studies Advanced Elective	2	1
	Two Electives †	4	2
		13½	6½

† 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 1975.

374. SURVEYING – SANDWICH COURSE

Bachelor of Surveying

The first two parts of the Sandwich Course may be completed (a) Full-time, by taking one full-time year, or (b) Part-time, by taking Stages 1 and 2, or (c) Sandwich, by taking Part 1 in Session 1 and Part 2 in Session 2 of the following year. See diagram below.

a) **Full-time**
See Year 1, Full-time course.

b) **Part-time**

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 1					
1.001	Physics I	3	3	3	3
10.001	Mathematics I	4	2	4	2
		7	5	7	5

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
STAGE 2					
5.010	Engineering A*	4	2	0	0
5.030	Engineering C**	0	0	3	2
29.001	Surveying IA	3	2½	0	0
29.002	Surveying IB	0	0	1	5½
		7	4½	4	7½

* 4.901 Materials Option.
**Introduction to Systems and Computers Option.

c) Sandwich Course

PART 1 – *Offered in Session 1*

1.001	Physics I (Part 1)	3	3
5.030	Engineering C†	3	2
10.001	Mathematics I (Part 1)	4	2
29.001	Surveying IA	3	2½
		13	9½

† Introduction to Systems and Computers Option.

PART 2 – *Offered in Session 2**

1.001	Physics I (Part 2)	3	3
5.010	Engineering A†	4	2
10.001	Mathematics I (Part 2)	4	2
29.002	Surveying IB	1	5½
		12	12½

* Commences in 1976.
† 4.901 Materials Option.

PART 3 – *Offered in Session 1*

10.022	Mathematics II (Part 1)	2	2
10.341	Statistics	3	0
29.102	Surveying II	3½	5½
29.151	Survey Computations I	3½	2½
31.212	Geometrical Optics	1½	1½
		13½	11½

PARTS 4 to 8
Not offered in 1975.

374. SURVEYING – PART-TIME COURSE

Bachelor of Surveying

STAGE 3

No longer offered.

STAGE 4

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
6.822	Electronics	0	0	1	2
8.711	Engineering for Surveyors	3	0	0	0
10.341	Statistics	3	0	0	0
27.293	Physical Geography for Land Assessment†	0	0	2	2
29.192	Survey Camp*	–	–	–	–
29.161	Hydrographic Surveying I *or* 29.182 Cartography Elective	0	0	1	1
31.212	Geometrical Optics	1½	1½	0	0
	General Studies Elective	1	½	1	½
		8½	2	5	5½

* Students are required to attend a two-week survey camp, held in October, equivalent to 80 class contact hours.

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

STAGE 5

8.712	Engineering for Surveyors	1½	0	1½	0
29.211	Geodesy I	2	1	2	1
29.311	Astronomy I	2	1	0	0
29.612	Land Studies II†	0	0	4	1
36.411	Town Planning	1½	1½	0	0
	General Studies Elective	1	½	1	½
		8	4	8½	2½

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

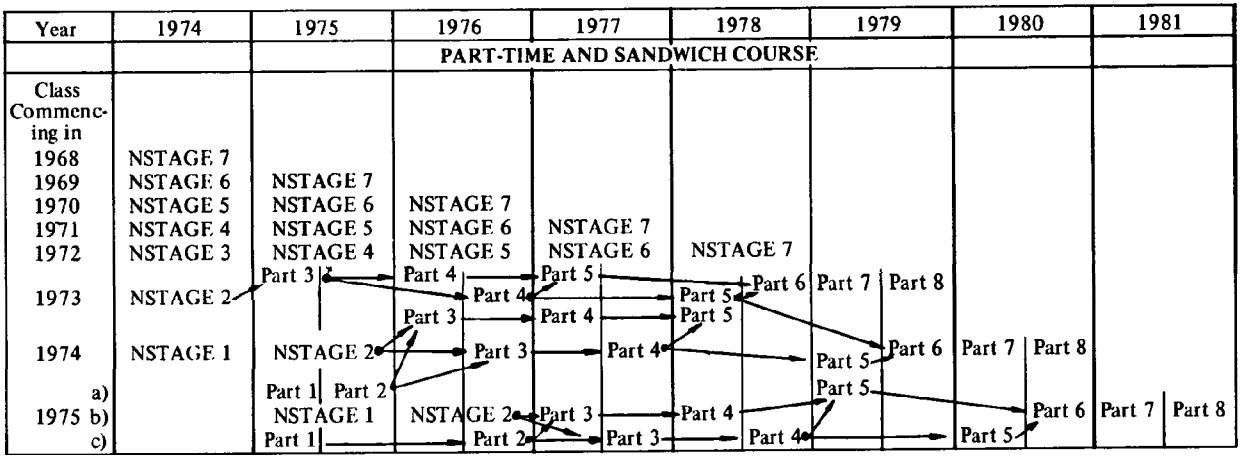
		Hours per week for 2 sessions Lec.	Lab. Tut.
STAGE 6			
29.103	Surveying III	2	1½
29.152	Survey Computation II	1	½
29.511	Photogrammetry I	1½	1½
29.613	Land Studies III	1	0
29.614	Land Studies Project	½	1
	General Studies Elective	1	½
	General Studies Advanced Elective	1	½
		8	5½
STAGE 7*			
29.212	Geodesy II	1	½
29.312	Astronomy II	1	½
29.512	Photogrammetry II	1	½
8.713	Management for Surveyors	1	0
	Two Electives §	2	1
29.194	Survey Camp†		
		6	2½

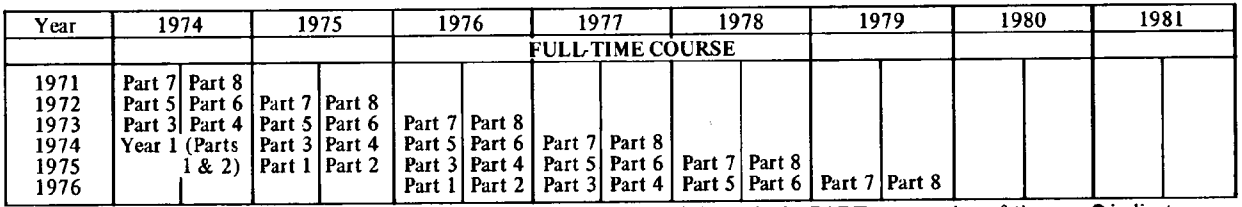
* Students normally must fulfil the academic requirements of the subject, 29.193 Professional Training, before attempting Stage 7.

† 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.

§ Electives chosen from
29.162 Hydrographic Surveying II ††
29.183 Cartography Advanced Elective ††
29.213 Geodesy III
29.313 Astronomy III
29.513 Photogrammetry III
29.615 Land Studies
29.173 Project

†† Not offered in 1975.





NOTE: **STAGE:** a part-time stage of the existing course. **NSTAGE:** A part-time stage of the revised course equivalent in material to one part. **PART:** one session of the revised course, which comprises eight parts. ● indicates a choice of course.

METHOD OF IMPLEMENTATION OF REVISED BACHELOR OR SURVEYING COURSE

DESCRIPTIONS OF SUBJECTS

TEXT AND PRINCIPAL REFERENCE BOOKS

(For General Studies subjects see the Department of General Studies Handbook.)

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

5.010 Engineering A

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

(i) *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

(ii) (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.* N.S.W. U.P.

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:*

McClintock, 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. Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

For *Engineering Mechanics:*

Beer, F. P. & Johnston, E. R. *Statics and Dynamics.* Vector ed. McGraw-Hill.

Meriam, J. L. *Statics and Dynamics.* Wiley.

For *Introduction to Engineering Design:*

Harrisberger, L. *Engineermanship.* Wadsworth.

Krick, E. V. *Introduction to Engineering and Engineering Design.* Wiley.

For *Introduction to Materials I:*

Clark, D. S. & Varney, W. R. *Physical Metallurgy for Engineers.* Van Nostrand Reinhold.

Gordon, J. E. *The New Science of Strong Materials, or Why You Don't Fall Through the Floor.* Pelican.

Street, A. *Metals in the Service of Man.* Pelican.

5.020 Engineering B

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.

and either

(i) *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.

or

(ii) (Civil Engineering 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 *Introduction to Systems & Computers:*

Karbowiak, A. E. & Huey, R. M. *Information Computers, Machines and Man.* Wiley.

For *Mechanics of Solids I:*

Hall, A. S. *Introduction to Mechanics of Solids.* Wiley.

PRINCIPAL REFERENCE BOOKS

For *Engineering Mechanics:*

Beer, F. P. & Johnston, E. R. *Statics and Dynamics.* Vector ed. McGraw-Hill.

Meriam, J. L. *Statics and Dynamics.* Wiley.

5.030 Engineering C

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)

(i) *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.

(ii) (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.

(iii) *Introduction to Systems and Computers:* As for 5.020 Engineering B(i).

(iv) (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.

(v) (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.

(vi) (Mining Engineering and Industrial Arts students must take this option) *Mechanics of Solids I:* As for 5.020 Engineering B (ii).

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 & 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.

PRINCIPAL REFERENCE BOOKS
For *Introduction to Materials II:*
Clark, D. S. & Varney, W. R. *Physical Metallurgy for Engineers.* Van Nostrand Reinhold.

For *Introduction to Engineering Construction:*
Pannell, A. N. *History of Civil Engineering.* Wiley.
Antill, J. M. & Ryan, P. W. S., *Civil Engineering Construction.* 4th ed. A & R.
Peurifoy, R. L. *Construction Planning, Equipment and Methods.* 2nd ed. McGraw-Hill.

For *Introduction to Metallurgical Engineering:*
Aitchison, L. *A History of Metals.* Vols I & II. McDonald & Evans.
Dennis, W. H. *Extractive Metallurgy.* McGraw-Hill.
Guy, A. C. *Physical Metallurgy for Engineers.* Addison-Wesley.
Woodcock, J. T. ed. *The Australian Mining, Metallurgical and Mineral Industry, Vol. 3. Eighth Commonwealth Mining & Metallurgical Congress.* The Australasian Institute of Mining and Metallurgy.

5.032 Experimental Engineering II

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, 1969.

5.033 Experimental Engineering III

Prerequisite: 5.032. Co- or prerequisite: 5.071.

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

5.042 Industrial Experience

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

5.043 Industrial Training I
5.044 Industrial Training II

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

Prerequisite: All subjects in Years 1, 2 and 3. Co- or prerequisite: 5.324.

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

5.061 Technical Orientation

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.

PRINCIPAL REFERENCE BOOKS

Roget's Thesaurus.

The Concise Oxford Dictionary.

Ulman, J. N. Jr. *Technical Reporting.* Holt, Rinehart & Winston, 1952.

5.062 Communications

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.

PRINCIPAL REFERENCE BOOKS

Davis, D. *The Grammar of T.V. Production.* Barrie.

McLuhan, M. *Understanding Media.* Sphere.

Willis, A. H. *The Technical Lecture.* Quest.

5.071 Engineering Analysis

Prerequisite: 10.022.

Digital Computer Programming: Numerical Methods – Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations – series and stepwise methods. Solution of partial differential equations – finite difference and iterative methods. Emphasis to be placed on the use of digital computers. Statistics – an introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of X^2, t and F. Estimation by moments and maximum likelihood: confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction of linear regression.

TEXTBOOKS

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

Statistical Tables.

PRINCIPAL REFERENCE BOOKS

Derman, C. & Klein, M. *Probability and Statistical Inference for Engineers.* O.U.P.

Freeman, H. *Introduction to Statistical Inferences.* Addison-Wesley.

Hald, A. *Statistical Theory with Engineering Applications.* Wiley.

Martin, H. C. & Carey, G. F. *Introduction to Finite Element Analysis.* McGraw-Hill.

Nielsen, K. L. *Methods in Numerical Analysis.* Macmillan.

Plumb, S. C. *Introduction to Fortran Programming.* McGraw-Hill.

Salvadori, M. G. & Baron, M. L. *Numerical Methods in Engineering.* Prentice-Hall.

Southworth, R. W. & De Leeuw, S. L. *Digital Computation and Numerical Methods.* McGraw-Hill.

Smith, G. D. *Numerical Solution of Partial Differential Equations,* O.U.P., 1974.

5.111 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.

TEXTBOOKS

Australian Standard Engineering Drawing Practice. I.E. Aust., 1973.

Grant, H. E. *Engineering Drawing with Creative Design.* McGraw-Hill.

Shigley, J. E. *Mechanical Engineering Design.* 2nd ed. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

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

Faires, V. M. *Design of Machine Elements.* Collier-Macmillan.

5.112 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.

Text and Principal Reference Books as for 5.111, together with:

TEXTBOOK

French, M. J. *Engineering Design, Conceptual Stage.* H.E.B.

PRINCIPAL REFERENCE BOOKS

B.S. 2517. Definitions for Use in Mechanical Engineering. B.S.I., 1959.

Merritt, H. E. *Gear Engineering.* Pitman.

Miles, L. D. *Techniques of Value Analysis and Engineering.* McGraw-Hill.

Oberg, E. & Jones. F. D. *Machinery's Handbook.* Machinery Pub.

Woodson, T. T. *Introduction to Engineering Design.* McGraw-Hill.

5.113 Mechanical Engineering Design III

Prerequisites: 5.112, 5.331, 5.412. Co- or prerequisites: 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.

PRINCIPAL REFERENCE BOOKS

As for 5.112, together with:

Asimow, M. *Introduction to Design.* Prentice-Hall.

Faires, V. M. *Design of Machine Elements.* 4th ed. Macmillan.

Goodwin, A. B. *Power Hydraulics.* Cleaver-Hume Press.

Johnson, R. C. *Optimisation of Mechanical Elements.* Wiley.

Juvinall, R. C. *Engineering Consideration of Stress, Strain & Strength.* McGraw-Hill.

Shigley, J. E. *Mechanical Engineering Design.* 2nd ed. McGraw-Hill.

5.301 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.

PRINCIPAL REFERENCE BOOK

Beer, F. P. & Johnston, E. *Mechanics for Engineers: Dynamics.* Vector ed. McGraw-Hill.

5.303 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.

PRINCIPAL REFERENCE BOOKS

Church, A. H. *Mechanical Vibrations.* Wiley.

Thomson, W. T. *Vibration Theory and Applications.* Prentice-Hall.

5.311 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.

PRINCIPAL REFERENCE BOOKS

Beer, F. P. & Johnston, E., *Mechanics for Engineers: Dynamics.* Vector ed. McGraw-Hill.

Higdon, A. & Stiles, W. B. *Engineering Mechanics.* Vector ed. Prentice-Hall.

Waldron, K. J. *Engineering Mechanics.* Wiley.

5.324 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.

PRINCIPAL REFERENCE BOOKS

Atkinson, P. A. T. *Feedback Control Theory for Engineers.* H.E.B.

Dransfield, P. *Engineering Systems & Automatic Control.* Prentice-Hall.

Harrison, H. L. & Bollingen, J. G. *Introduction to Automatic Control.* 2nd ed. International Text Book.

Raven, F. H. *Automatic Control Engineering.* 2nd ed. McGraw-Hill.

5.331 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.

TEXTBOOKS

Hirschhorn, J. *Dynamics of Machinery.* Nelson.

PRINCIPAL REFERENCE BOOKS

Church, A. H. *Mechanical Vibrations.* Wiley.

Mabie, H. H. & Ocvirk, F. W. *Mechanics and Dynamics of Machinery.* Wiley.

Merrit, H. E. *Gear Engineering.* Pitman.

5.332 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.

PRINCIPAL REFERENCE BOOKS

Church, A. H. *Mechanical Vibrations.* Wiley.

Den Hartog, J. P. *Mechanical Vibrations.* McGraw-Hill.

Hartenberg, R. S. & Denavit, J. *Kinematic Synthesis of Linkages.* McGraw-Hill.

Hirschhorn, J. *Kinematics and Dynamics of Plane Mechanisms.* McGraw-Hill.

Thomson, W. T. *Vibration Theory and Applications.* Prentice-Hall.

5.412 Mechanics of Solids I

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

Seely, F. B. & Smith, J. O. *Advanced Mechanics of Materials.* Wiley, 1952.

PRINCIPAL REFERENCE BOOKS

Den Hartog, J. P. *Advanced Strength of Materials.* McGraw-Hill, 1952.

Higdon, A. et al. *Mechanics of Materials.* Wiley.

Juvinall, R. C. *Engineering Considerations of Stress, Strain and Strength.* McGraw-Hill, 1967.

Shanley, F. R. *Mechanics of Materials.* McGraw-Hill.

Timoshenko, S. *Strength of Materials.* Parts I and II. Van Nostrand.

5.413 Mechanics of Solids II

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.

PRINCIPAL REFERENCE BOOKS

Ford, H. *Advanced Mechanics of Materials.* Longman.

Den Hartog, J. P. *Advanced Strength of Materials.* McGraw-Hill, 1952.

Johnson, W. J. & Mellor, P. B. *Engineering Plasticity.* Van Nostrand, 1973.

Seely, F. B. & Smith, J. O. *Advanced Mechanics of Materials.* Wiley.

5.611 Fluid Mechanics / Thermodynamics I

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

Streeter, V. L. *Fluid Mechanics.* 4th ed. McGraw-Hill.

or

Massey, B. S. *Mechanics of Fluids.* Van Nostrand.

Wark, K. *Thermodynamics.* 2nd ed. McGraw-Hill, 1971.

or

Lee, J. F. & Sears, F. W. *Thermodynamics.* 2nd ed. Addison-Wesley.

Reynolds, W. *Thermodynamics.* 2nd ed. McGraw-Hill, 1968.

5.612 Fluid Mechanics / Thermodynamics II

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.* 2nd 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.

PRINCIPAL REFERENCE BOOK

Sharpe, G. J. *Fluid Flow Analysis.* Heinemann, 1967.

5.613 Fluid Mechanics / Thermodynamics III

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. General thermodynamics relations. Statistical mechanics. Quantum mechanics. Monatomic gases and solids. Diatomic and polyatomic gases. Chemical equilibrium. Statistical mechanics of dependent particles. Real gases and solids. Irreversible processes.

PRINCIPAL REFERENCE BOOKS

Kays, W. M. *Convection Heat and Mass Transfer.* McGraw-Hill, 1966.

Shepherd, D. G. *Principles of Turbomachinery.* Macmillan, 1957.

Van Wylen, G. J. & Sonntag, R. E. *Fundamentals of Classical Thermodynamics.* Wiley, 1965.

Van Wylen, G. J. & Sonntag, R. E. *Fundamentals of Statistical Thermodynamics.* Wiley, 1966.

5.661 Mechanical Engineering III

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

John, J. & Haberman, W. *Introduction to Fluid Mechanics.* Prentice-Hall, 1971.

Rogers, G. F. C. & Mayhew, Y. R. *Engineering Thermodynamics Work & Heat Transfer,* 2nd ed. (S.I. Units). Longman, 1967.

5.711 Thermodynamics

Prerequisites: 1.001, 5.010, 5.020, 10.001.

The system; work and heat interactions. Properties of pure substances. First law of thermodynamics. Steady flow processes. Second law of thermodynamics. Power and refrigeration cycles; air standard cycles.

TEXTBOOK

Van Wylen, G. J. *Thermodynamics.* SI unit ed. Wiley.

5.800 Aircraft Design

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.

5.801 Aircraft Design

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

(a) *Aerodynamic Design* – Design authorities, criteria, flight envelope, design cases. Airloads. Weight and Balance. Performance and stability estimation. Aerodynamic design of an aircraft.

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

TEXTBOOKS

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

Maccabee, F. ed. *Light Aircraft Design Handbook.* Loughborough Univ. of Technology, 1969.

Royal Aeronautical Society. *Handbook of Aeronautics No. 1, Structural Principles and Data.* Pitman.

PRINCIPAL REFERENCE BOOKS

Ashkouti, J. A. *Aircraft Mechanics Pocket Manual.* Pitman, 1957.

Australian Department of Civil Aviation. *Air Navigation Orders, Sections 100, 101.* D.C.A.

Horner, S. F. *Fluid Dynamic Drag.* Horner.

Pazmany, L. *Light Aircraft Design.* Author, San Diego, Calif. 1963.

Royal Aeronautical Society. *Data Sheets.* R.Ae.S.

Shanley, F. R. *Weight-Strength Analysis of Aircraft Structures.* 2nd ed. Dover, 1965.

U.K. Air Registration Board. *British Civil Airworthiness Requirements. Sections D, K.* A.R.B.

U.S. Federal Aviation Agency. *Federal Aviation Regulations Part 23: Airworthiness Standards.*

Wood, K. D. *Aerospace Vehicle Design. Vol. 1. Aircraft Design.* Univ. of Colorado, 1963 or later.

5.811 Aerodynamics I

Prerequisites: 5.311, 5.611, 10.022.

Navier-Stokes equations; elementary boundary layer theory; turbulence, convection, friction and form drag; airfoil characteristics. Vorticity and circulation; Prandtl wing theory, induced drag, spanwise lift distribution, wing characteristics. Static longitudinal stability and control. Manoeuvrability. Standard atmosphere, performance calculations. One-dimensional gas dynamics, isentropic, adiabatic and nozzle flow; rocket equation.

PRINCIPAL REFERENCE BOOKS

Abbott, I. H. & Von Doenhoff, A. E. *Theory of Wing Sections.* Dover.

Glauert, H. *The Elements of Aerofoil & Airscrew Theory.* C.U.P.

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.

Rauscher, M. *Introduction to Aeronautical Dynamics.* Wiley.

Royal Aeronautical Society Data Sheets. *Aerodynamics and Performance.*
Streeter, V. L. *Fluid Dynamics.* McGraw-Hill.
Von Karman, T. *Aerodynamics.* Cornell U.P., 1954.

5.812 Aerodynamics II

Prerequisites: 5.811, 5.303.

Potential theory of an ideal fluid, conformal Kutta-Joukowski transformation. Vortex streets. Aircraft dynamic stability. Advanced performance calculations. Normal oblique and conical shock and expansion waves. High speed wing theory.

TEXTBOOKS

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.

PRINCIPAL REFERENCE BOOKS

Etkin, B. *Dynamics of Flight.* 2nd ed. Wiley.
Gessow, A. & Myers, G. C. *Aerodynamics of the Helicopter.* Macmillan.
Royal Aeronautical Society. *Aerodynamics and Performance Data Sheets.* R.Ae.S.
Schlichting, H. *Boundary Layer Theory.* McGraw-Hill.
Seckel, E. *Stability and Control of Aeroplanes and Helicopters.* A.P., 1964.

5.822 Analysis of Aerospace Structures I

Prerequisites: 5.311, 8.151, 8.259, 10.022. Co- or prerequisites: 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. Semi-monocoque structures. Deflection of structures: Maxwell's and Castigliano's theorems, virtual work method. Statically indeterminate structures; beams, trusses, stiff-jointed frames; methods of superposition, energy, moment distribution, elastic centre; shear distribution in two-cell beam. Aircraft materials, physical properties and their measurement. Dimensionless stress-strain data.

TEXTBOOK

Peery, D. J. *Aircraft Structures.* McGraw-Hill.

PRINCIPAL REFERENCE BOOK

Timoshenko, S. *Strength of Materials.* Part I. Van Nostrand.

5.823 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

Rivello, R. M. *Theory and Analysis of Flight Structures.* McGraw-Hill, 1969.

PRINCIPAL REFERENCE BOOKS

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

Hendry, A. W. *Elements of Experimental Stress Analysis.* Pergamon.

Timoshenko, S. & Gere, J. M. *Theory of Elastic Stability.* McGraw-Hill, 1961.

Timoshenko, S. & Goodier, J. M. *Theory of Elasticity.* McGraw-Hill, 1970.

Williams, D. *Theory of Aircraft Structures.* Arnold, 1960.

5.831 Aircraft Propulsion

Prerequisites: 5.611, 5.811.

Aircraft power plant and propulsion systems. Basic 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.

PRINCIPAL REFERENCE BOOKS

Shapiro, A. H. *Dynamics and Thermodynamics of Compressible Fluid Flow.* Vol. I. Ronald, 1953.

Shepherd, D. G. *Introduction to the Gas Turbine.* Constable, London.

Sutton, G. P. *Rocket Propulsion Elements.* 3rd ed. Wiley.

Zucrow, M. J. *Principles of Jet Propulsion and Gas Turbines.* Wiley, N.Y.

5.911 Naval Architecture

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, 1967.

PRINCIPAL REFERENCE BOOKS

Rawson, K. J. & Tupper, E. C. *Basic Ship Theory.* Longman, 1968.

Robb, A. M. *Theory of Naval Architecture.* Griffin & Co.

5.921 Ship Structures I

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 Architects & Marine Engineers, N.Y., 1967.

PRINCIPAL REFERENCE BOOKS

Clarkson, J. *The Elastic Analysis of Flat Grillages.* C.U.P., 1965.

D'Arcangelo, A. M. *A Guide to Sound Ship Construction.* Cornell Maritime Press, 1964.

D'Arcangelo, A. M. *Ship Design and Construction.* Soc. of Naval Architects & Marine Engineers, N.Y., 1969.

Evans, J. H. *Ship Structural Design Concepts.* Nat. Tech. Inf. Service. Springfield, Va., 1974.

Lloyd's Register of Shipping. *Rules and Regulations for the Construction and Classification of Steel Ships.* Published Annually.

Muckle, W. *Strength of Ships' Structures.* Arnold, 1967.

5.922 Ship Structures II

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 921.

5.931 Principles of Ship Design IA

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., 1964.

D'Arcangelo, A. M. *Ship Design and Construction.* Soc. of Naval Architects and Marine Engineers, N.Y., 1969.

5.932 Principles of Ship Design IB

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

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

PRINCIPAL REFERENCE BOOKS

The Commonwealth of Australia. *Statutory Rules, No. 25 Navigation (Construction) Regulations, 1968.*

The Commonwealth of Australia. *Statutory Rules, No. 126, Navigation (Load Lines) Regulations, 1968.*

Comstock, J. P. *Principles of Naval Architecture.* Soc. of Naval Architects and Marine Engineers, N.Y., 1967.

D'Arcangelo, A. M. *A Guide to Sound Ship Construction.* Cornell Maritime P., 1964.

D'Arcangelo, A. M. *Ship Design and Construction.* Soc. of Naval Architects and Marine Engineers, N.Y., 1969.

Department of Trade & Industry. *Tonnage Measurements of Ships – British.* H.M.S.O.

5.933 Principles of Ship Design II

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, N.Y., 1969.

PRINCIPAL REFERENCE BOOKS

The Commonwealth of Australia. *Statutory Rules, No. 25, Navigation (Construction) Regulations, 1968.*

The Commonwealth of Australia. *Statutory Rules, No. 126, Navigation (Load Lines) Regulations, 1968.*

Manning, G. C. *The Theory and Technique of Ship Design.* Wiley.

Munro-Smith, R. *Merchant Ship Design.* Hutchinson.

Schokker, J. C., Neuerburg, E. M. & Vossnack, E. J. *The Design of Merchant Ships* Arkenbout-Schokker.

Todd, F. H. *Ship Hull Vibration.* Arnold.

5.934 Ship Design Project

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 5.933.

5.941 Ship Propulsion 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, N.Y., 1967.

PRINCIPAL REFERENCE BOOKS

Barnaby, K. C. *Basic Naval Architecture,* 5th ed. Hutchinson.

Harrington, R. L. ed. *Marine Engineering.* Soc. of Naval Architects & Marine Engineers, N.Y., 1971.

O'Brien, T. P. *The Design of Marine Screw Propellers.* Hutchinson.

Robb, A. M. *Theory of Naval Architecture.* Griffin & Co.

Todd, F. H. *Ship Hull Vibration.* Arnold.

Van Lammeren, W. P. A. *Resistance, Propulsion and Steering of Ships.* Technical Publishing Co., Holland.

5.951 Hydrodynamics

Prerequisites: 5.311, 5.611, 10.022. Co- or prerequisites: 5.071.

Kinematics of fluids: stream function, velocity potential and application. Elementary treatment of equations of motion and examples in hydrodynamics.

PRINCIPAL REFERENCE BOOKS

Inst. Mech. Engrs., London. *Procs. Intl. Symp on Directional Stability & Control of Bodies Moving in Water.* J. Mech. Eng. Sci., Vol. 14, No. 7, Sup. Issue, 1972.

Li, W. H. & Lam, S. H. *Principles of Fluid Mechanics.* Addison-Wesley.

Milne-Thomson, L. M. *Theoretical Hydrodynamics.* Macmillan.

SCHOOL OF ELECTRICAL ENGINEERING

6.010 Electrical Engineering I

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

To be advised.

6.021 Electrical Engineering II

Prerequisites: 1.001, 6.010, 10.001.

A unified treatment of electrical engineering:

A. SI units. Fundamental laws of electromagnetic field thoery. Circuit theory: Kirchhoffs laws, basic elements, power relations. Analysis of linear circuits: systematic circuit equations, phasors, impedance, poles and zeros, transient and complete response, general network theorems.

B. Solid-state electronics: semiconductors, electrons and holes, doping, energy bands, Fermi-Dirac statistics, diffusion. The p-n diode and circuit applications. The junction transistor and circuit applications. Linear analysis of electronic circuits.

C. Magnetic fields and circuits. Transformers, equivalent circuits. Electromechanical energy conversions, torque induced voltage. Rotating machines: dc, synchronous and induction types, analysis by equivalent circuits.

TEXTBOOKS

Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.

Ryder, J. D. *Electronic Fundamentals and Applications.* 4th ed. Pitman.

REFERENCE BOOKS

Fitzgerald, A. E., Grabel, A. & Higgenbotham, D. E. *Basic Electrical Engineering.* 3rd ed. McGraw-Hill.

Fink, D. G. ed. *Standard Handbook for Electrical Engineers.* (Knowlton.) 10th ed. McGraw-Hill.

Millman, J. & Halkias, C. C. *Electronic Devices and Circuits.* McGraw-Hill, 1967.

Smith, M. I. & Hosie, K. T. *Basic Electrical Engineering Science.* Longman.

Smith, R. J. *Circuits, Devices and Systems.* Wiley.

6.031A 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, 1968.

Desoer, C. A. & Kuh, E. S. *Basic Circuit Theory.* McGraw-Hill, 1969.

Di Stepheno III, J. J., Stubberud, A. R. & Williams, I. J. *Feedback and Control Systems.* Schaum's Outline Series. McGraw-Hill, 1967.

PRINCIPAL REFERENCE BOOKS

Close, C. M. *The Analysis of Linear Circuits.* Harcourt, Brace & Jovanovich.

Elgerd, O. I. *Control Systems Theory.* McGraw-Hill, 1967.

Frederick, D. K. & Carlson, A. B. *Linear Systems in Communications and Control.* Wiley, 1971.

Kuo, T. I. *Automatic Control Systems.* 2nd ed. Prentice-Hall, 1967.

Auslander, D. M.,Takahashi, Y. & Robins, M. J. *Introducing Systems & Control.* McGraw-Hill, 1974.

Seely, S. *An Introduction to Engineering Systems.* Pergamon, 1972.

Moore, R. K. *Travelling-wave Engineering.* McGraw-Hill, 1960.

Newcomb, R. W. *Concepts of Linear Systems and Controls.* Brooks-Cole, 1968.

Seshu, S. & Balabanian, N. *Linear Network Analysis.* Wiley, 1959.

6.031B 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.

PRINCIPAL REFERENCE BOOKS

Freeman, P. J. *Electric Power Transmission and Distribution.* Harrap.

Stevenson, W. D. *Elements of Power System Analysis.* 2nd ed. McGraw-Hill.

6.031C 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, 1972.

Tobey, G. E., Graeme, J. G. & Huelsman, L. *Operational Amplifiers: Design and Application.* I.S.E. McGraw-Hill, 1971.

PRINCIPAL REFERENCE BOOKS

Abrahams, J. & Pridham, G. *Semiconductor Circuits: Worked Examples.* Pergamon.

Gibbons, J. *Semiconductor Electronics.* McGraw-Hill.

Phillips, A. *Transistor Engineering.* McGraw-Hill.

6.031D Computing

Prerequisite: 10.001

Numbers 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.

PRINCIPAL REFERENCE BOOKS

Hill, F. J. & Peterson, G. R. *Introduction to Switching Theory & Logical Design.* Design. Wiley.

Lewin, C. G. *Logical Design of Switching Circuits.* Nelson.

McCluskey, E. J. *Introduction to the Theory of Switching Circuits.* McGraw-Hill.

Marcus, M. P. *Switching Circuits for Engineers.* Prentice-Hall.

6.031E 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. Statistics. 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, 1972.

PRINCIPAL REFERENCE BOOKS

Gray, P. E. & Searle, C. L. *Electronic Principles, Physics, Models and Circuits.* Wiley, 1969.

Phillips, A. B. *Transistor Engineering.* McGraw-Hill, 1962.

Van der Ziel, A. *Solid State Physical Electronics.* 2nd ed. Prentice-Hall, 1968.

6.041 Fields and Measurements

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.

PRINCIPAL REFERENCE BOOKS

Moore, R. K. *Wave and Diffusion Analogies.* McGraw-Hill, 1964.

Reitz, J. R. & Milford, F. J. *Foundations of Electronmagnetic Theory.* Addison-Wesley, 1960.

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.

PRINCIPAL REFERENCE BOOKS

Hague, B. *Alternating Current Bridge Methods.* 6th ed. Rev. Foord, T. Pitman.

Harris, F. K. *Electrical Measurements.* Wiley.

Oliver, B. M. & Cage, J. M. *Electronic Measurements and Instrumentation.* McGraw-Hill.

Terman, F. M. & Pettit, J. M. *Electronic Measurements.* McGraw-Hill.

6.042 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, 1969.

PRINCIPAL REFERENCE BOOKS

Beckmann, P. *Probability in Communication Engineering.* Harcourt Brace & World, 1967.

Carlson, A. B. *Communication Systems.* McGraw-Hill, 1968.

Heinlein, W. E. & Holmes, W. H. *Active Fillers for Integrated Circuits.* Oldenburg/ Prentice-Hall, 1974.

Lathi, B. *Random Signals and Communication Theory.* International Textbook, 1970.

Reza, F. M. *An Introduction to Information Theory.* McGraw-Hill, 1961.

Weinberg, L. *Network Analysis and Synthesis.* McGraw-Hill, 1962.

6.043 Electrical Measurements

Measurements section of 6.041 Fields and Measurements.

TEXTBOOK

Stout, M. B. *Basic Electrical Measurements.* Prentice-Hall.

PRINCIPAL REFERENCE BOOKS

Hague, B. & Foord, T. R. *Alternating Current Bridge Methods.* 6th ed. Pitman.

Harris, F. K. *Electrical Measurements.* Wiley.

Oliver, B. M. & Cage, J. M. eds. *Electronic Measurements and Instrumentation.* McGraw-Hill.

Terman, F. M. & Pettit, J. M. *Electrical Measurements.* McGraw-Hill.

6.044 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.

PRINCIPAL REFERENCE BOOKS

Shooman, M. L. *Probabilistic Reliability, An Engineering Approach.* McGraw-Hill, 1968.

Standards, published by Australian Dept. of Defence:

DEF(Aust) 247. *Climatic, Shock and Vibration Testing of Service Equipment.*

DEF(Aust) 3017. *Reliability Prediction for Electronic Equipment.*

Standard, pub. by Standards Association of Australia: AS 1199 *Sampling by Attributes.*

Woodson, T. T. *Introduction to Engineering Design.* McGraw-Hill, 1966.

Nixon, F. *Managing to Achieve Quality and Reliability.* McGraw-Hill, 1971.

6.202 Power Engineering – Systems I

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, 1963.

PRINCIPAL REFERENCE BOOKS

M.I.T. Staff. *Magnetic Circuits and Transformers.* Wiley.

Westinghouse Electric Corporation. *Electrical Transmission and Distribution Reference Book.*

Guile, A. E. & Paterson, W. *Electrical Power Systems.* Vols I & II. Oliver & Boyd, 1972.

6.203 Power Engineering – Systems II

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

Stevension, W. D. *Elements of Power System Analysis.* 2nd ed. McGraw-Hill, 1963.

PRINCIPAL REFERENCE BOOKS

Elgerd, O. I. *Electric Energy System Theory – an Introduction.* McGraw-Hill, 1971.

Guile, A. E. & Paterson, W. *Electrical Power Systems.* Vols I & II. Oliver & Boyd, 1972.

Kimbark, E. W. *Power System Stability.* Vols I, II & III. Wiley.

Taylor, E. O. & Boal, G. A. eds. *Electric Power Distribution.* Arnold, 1966.

6.212 Power Engineering – Utilization

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 programme of experimental projects and applications of design will accompany the lectures.

PRINCIPAL REFERENCE BOOKS

Adkins, B. *The General Theory of Electrical Machines.* Chapman & Hall.

Bedford, B. D. & Hoft, R. G. *Principles of Inverter Circuits.* Wiley.

Brown, G. H., Hoyler, C. N. & Bierwirth, R. A. *Theory and Application of Radio Frequency Heating.* Van Nostrand.

Ranshaw, R. *Power Electronics.* Chapman & Hall.

Tustin, A. *Direct Current Machines for Control Systems.* Sporn.

6.222 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.

TEXTBOOKS

No set text.

PRINCIPAL REFERENCE BOOKS

Alston, L. L. *High Voltage Technology.* Harwell/O.U.P.

Carter, G. W. *The Electromagnetic Field in its Engineering Aspects.* Longman.

Fishlock, D. *A Guide to Superconductivity.* Macdonald/Elsevier.

Kuffel, E. & Abdullah, M. *H. V. Engineering.* Pergamon.

Moon, P. & Spencer, D. E. *Foundations of Electrodynamics.* Van Nostrand.

Schwab, A. *High Voltage Measurement Techniques.* M.I.T. Press.

6.303 Communication Electronics

Prerequisites: 6.031A, 6.031C, 6.031E.

High frequency 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.

TEXTBOOK

No set text.

PRINCIPAL REFERENCE BOOKS

Bloom, A. L. *Gas Lasers.* Wiley, 1968.

Carroll, J. E. *Hot Electron Microwave Generators.* Arnold, 1970.

Dix. C. H. & Aldour, W. H. *Microwave Valves.* Illiffe, 1966.

Gibbons, G. *Avalanche Diode Microwave Oscillators.* O.U.P. 1973.

Glazier, E.V.D. & Lamont, H. R. L. *Transmission and Propagation.* H.M.S.O., 1958.

Haykin, S. S. *Active Network Theory.* Addison-Wesley, 1970.

Howson, D. P. & Smith, R. B. *Parametric Amplifiers.* McGraw-Hill, 1970.

Jolly, W. P. *Low Noise Electronics.* English Universities Press, 1967.

S.E.E.C. *Semi-Conductor Electronics Education Committee Series.* Vols. III, IV, V. Wiley, 1966.

Thorp, J. S. *Masers and Lasers.* Macmillan, 1967.

Watson, H. A. ed. *Microwave Semi-Conductor Devices and Their Circuit Applications.* McGraw-Hill, 1969.

6.313 Wave Radiation and Guidance

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.

TEXTBOOK

No set text.

PRINCIPAL REFERENCE BOOKS

Glazier, E. V. D. & Lamont, H. R. L. *Transmission and Propagation.* H.M.S.O., 1958.

Jasik, H. *Antenna Engineering Handbook,* McGraw-Hill

Jordan, E. C. & Balmain K. G. *Electromagnetic Waves and Radiating Systems.* Prentice-Hall.

Ramo, S., Whinnery, J. R., & Van Duzer, T. *Fields and Waves in Communication Electronics.* Wiley, 1965.

6.322 Electronics

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.

PRINCIPAL REFERENCE BOOKS

Bedford, B. D. & Hoft, R. G. *Principles of Inverter Circuits.* Wiley.

Gardner, F. M. *Phasebook Techniques.* Wiley.

Hemingway, T. K. *Electronic Designers Handbook.* Business Publications.

Klapper, J. & Frankel, J. T. *Phase-locked and Frequency Feedback Systems.* Academic.

Millman, J. & Halkias, C. C. *Integrated Electronics.* McGraw-Hill.

Millman, J. & Taub, H. *Pulse, Digital and Switching Waveforms.* McGraw-Hill.

Schaefer, J. *Rectifier Circuits.* Wiley.

Texas Instruments. *Transistor Circuit Design.* McGraw-Hill.

6.323 Signal Transmission

Co-requisite: 6.042.

Transmission System Environment: noise distortion; bandwidth; interference; multipath, fading; transmission media. *Analog Transmission:* baseband; linear and nonlinear 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.

PRINCIPAL REFERENCE BOOKS

Bennett, W. R. *Introduction to Signal Transmission.* McGraw-Hill, 1970.

Betts, J. A. *Signal Processing, Modulation and Noise.* Rev. ed. E.U.P., 1972.

Carlson, A. B. *Communication Systems.* McGraw-Hill, 1968.

Schwartz, M. *Information Transmission, Modulation and Noise.* 2nd ed. McGraw-Hill, 1970.

Taub, H. & Schilling, D. L. *Principles of Communication Systems.* McGraw-Hill. 1971.

6.333 Communication Systems

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, 1967.

or

Townsend, B. *PAL Colour Television.* C.U.P., 1970.

Showalter, L. C. *Closed Circuit T.V. for Engineers and Technicians.* Sams & Co., 1969.

Skolnik, M. I. *Introduction to Radar Systems.* McGraw-Hill, 1962.

PRINCIPAL REFERENCE BOOKS

Beranek, L. L. *Acoustics.* McGraw-Hill.

Brown, J. & Glazier, E. *Telecommunications.* Chapman & Hall, 1966.

Filipowsky, R. & Muehldorf, E. I. *Space Communications Systems.* Prentice-Hall, 1965.

Fraser, W. *Telecommunications.* Macdonald, 1957.

Hamsher, D. H. ed. *Communications System Engineering Handbook.* McGraw-Hill, 1967.

Millman, J. & Taub, H. *Pulse Digital and Switching Waveforms.* McGraw-Hill, 1965.

Olson, H. F. *Elements of Acoustical Engineering.* Van Nostrand.

Skolnik, M. I. *Introduction to Radar Systems.* McGraw-Hill, 1962.

Terman, F. E. *Electronic and Radio Engineering.* 4th ed. McGraw-Hill, 1955.

Townsend, B. *Pal Colour Television.* C.U.P., 1970.

Zworykin, V. K. & Morton, G. A. *Television.* Wiley.

6.383 Biomedical Engineering

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.

TEXTBOOK

Loewy, A. G. & Siekevitz, P. *Cell Structure and Function.* 2nd ed. Holt, Rinehart & Winston, 1970.

PRINCIPAL REFERENCE BOOKS

Geddes, L. A. & Baker, L. E. *Principles of Applied Biomedical Instrumentation.* Wiley, 1968.

Ruch, T. C. & Patton, H. D. eds. *Physiology and Biophysics.* Saunders, 1966.

6.412 Automatic Control

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, 1970.

PRINCIPAL REFERENCE BOOKS

Ogata, K. *Modern Control Engineering.* Prentice-Hall, 1970.

Saucedo, R. & Schiring, E. *Introduction to Continuous and Digital Control Systems.* Macmillan, 1968.

Stapleton, C. A. *Basic Control – Classic and Modern.* Univ. of N.S.W.

Takahashi, Y. et al. *Control and Dynamic Systems.* Addison-Wesley, 1970.

6.413 Modern Control Engineering

Prerequisite: 6.412

A basis for design of multivariable feedback systems using both state-space 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.

PRINCIPAL REFERENCE BOOKS

Brockett, R. W. *Finite Dimensional Linear Systems.* Wiley, 1970.

Chen, C. T. *Introduction to Linear System Theory.* Holt, Rinehart & Winston, 1970.

Noton, A. R. M. *Modern Control Engineering.* Pergamon, 1972.

Porter, B. *Synthesis of Dynamical Systems.* Nelson, 1969.

Timothy, L. K. & Bona, B. E. *State Space Analysis.* McGraw-Hill, 1968.

6.432 Computer Control and Instrumentation

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.

TEXTBOOKS

To be advised in class.

PRINCIPAL REFERENCE BOOK

Smith, C. L. *Digital Computer Process Control.* Intech, 1972.

6.512 Advanced Semiconductor Device Theory

Prerequisites: 6.031C, 6.031E.

Characteristics and limitations of semiconductor devices as functions of operating point and environment. Devices include high-frequency and power transistors, FETs, thyristors and negative resistance devices.

TEXTBOOK

Lindmayer, J. & Wrigley, C. *Fundamentals of Semiconductor Devices.* Van Nostrand, 1965.

PRINCIPAL REFERENCE BOOKS

Gentry, F. et al. *Semiconductor Controlled Rectifiers.* Prentice-Hall.

Gosling, W., Townsend, W. & Watson, J. *Field Effect Electronics.* Butterworths, 1971.

Grove, A. S. *Physics and Technology of Semiconductor Devices.* Wiley, 1967.

Van der Ziel, A. *Solid State Physical Electronics.* 2nd ed. Prentice-Hall, 1968.

6.522 Transistor and Integrated Circuit Design

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, 1967.

Warner, R. W. & Fordemwalt, J. N. *Integrated Circuits.* Vol. I. Motorola Series in Solid-State Electronics. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

To be advised in class.

6.601A Introduction to Computer Science

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

To be advised in class.

PRINCIPAL REFERENCE BOOKS

Bates, F. & Douglas, M. L. *Programming Language/One.* Prentice Hall.

Dahl, O. J., Dijkstra, E. W. & Hoare, C. A. R. *Structured Programming.* Academic.

Knuth, D. *Fundamental Algorithms. The Art of Computer Programming.* Vol. I. Addison-Wesley.

Maurer, H. A. & Williams, M. R. *A Collection of Programming Problems and Techniques.* Prentice-Hall.

Ralston, A. *Introduction to Programming and Computer Science.* McGraw-Hill.

Ralston, A. *Fortran IV Programming: A Concise Exposition.* McGraw-Hill.

Wirth, N. *Systematic Programming – An Introduction.* Prentice-Hall.

6.601B 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

*APL * CYBER Reference Manual.* Control Data Corp., 1973.

Griswold, R. E. Poage, J. F. & Polansky, I. P. *The SNOBOL 4 Programming Language.* 2nd ed. Prentice-Hall.

PRINCIPAL REFERENCE BOOKS

Barron, D. W. *Assemblers and Loaders.* Macdonald/Elsevier.

Campbell-Kelly, M. *An Introduction to Macros.* Macdonald/Elsevier.

I.B.M. System/360 Principles of Operation. Form A22.6821. I.B.M.

I.B.M. System/360 Assembler Language. Form C28.6514. I.B.M.

Katzan, H. *APL Programming and Computer Techniques.* Van Nostrand Reinhold.

Knuth, D. *The Art of Computer Programming.* Vols. 1, 2, 3. Addison-Wesley.

Maurer, H. A. & Williams, M. R. *A Collection of Programming Problems and Techniques.* Prentice-Hall.

6.612 Computer Systems Engineering

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, 1973.

PRINCIPAL REFERENCE BOOKS

Givone, D. D. *Introduction to Switching Circuit Theory.* McGraw-Hill, 1970.

Hill, F. J. & Peterson, G. R. *Introduction to Switching Theory and Logic Design.* Wiley, 1968.

Pakin, S. *APL/360: Reference Manual.* Science Research Associates, Inc., 1972.

Lewin, D. *Theory and Design of Digital Computers.* Nelson, 1972.

Lewin, D. *Logical Design of Switching Circuits.* Nelson, 1968.

6.622 Computer Application and Software

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

TEXTBOOK

No set text.

6.801 Electrical Engineering

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.

PRINCIPAL REFERENCE BOOKS

Doebelin, E. O. *Measurement Systems: Application & Design.* McGraw-Hill.

Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.

Malstadt, H. V. & Enke, C. G. *Electronic Measurements for Scientists.* Benjamin.

Norton, H. N. *Handbook of Transducers for Electronic Measuring Systems.* Prentice-Hall.

Spitzer, F. & Howarth, B. *Principles of Modern Instrumentation.* Holt, Rinehart & Winston.

Vassos, B. H. & Ewing, G. W. *Analog and Digital Electronics for Scientists.* Wiley – Interscience.

Wightman, E. J. *Instrumentation in Process Control.* Butterworths.

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.

PRINCIPAL REFERENCE BOOKS

Cotton, H. & Barber, H. *The Transmission and Distribution of Electrical Energy.* E.U.P.

Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.

Fitzgerald, A. E., Higginbotham, S. M. & Graybel, A. *Basic Electrical Engineering.* 3rd ed. McGraw-Hill.

Fitzgerald, A. E. & Kingsley, C. *Electric Machinery.* 1st ed. only. McGraw-Hill.

Kosow, I. L. *Control of Electrical Machines.* Prentice-Hall.

McGuinness, W. J. & Stein, B. *Mechanical & Electrical Equipment for Buildings.* 5th ed. Wiley.

6.802 Electrical Engineering

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, 1971.

6.822 Electronics

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, 1971.

PRINCIPAL REFERENCE BOOKS

Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.

References on electronic distance measurement to be advised.

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 fourth year of the BE course.

6.931 Group Thesis

For students in the fourth year of the BE course.

SCHOOL OF CIVIL ENGINEERING

8.001 Industrial Training

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

8.002 Industrial Experience

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 evidence from their employers confirming completion of the prescribed period of industrial training.

8.010 Project

Co-requisites: 8.152, 8.531.

Assignments in civil engineering topics.

8.011 Projects Year IV

8.012 Elements of Architecture

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

Not compatible with 8.019. Pre- or co-requisite: 8.153.

An introductory course in the design of road and railway bridges. Types of bridges, economic spans and proportions. Design loads and codes. Aspects of the design of steel, reinforced concrete, prestressed concrete, and composite bridges by empirical, elastic and limit state methods.

TEXTBOOKS

Beckett, D. *An Introduction to Structural Design. (1) Concrete Bridges.* Surrey U.P., 1973.

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.

PRINCIPAL REFERENCE BOOKS

A.A.S.H.O. *Specifications for Highway Bridges.* 1973.

A.I.S.C. *Moments Shears and Reactions for Continuous Highway Bridges.*

Abbett, R. W. ed. *American Civil Engineering Practice,* Vol. 3. Wiley, 1957.

Anon. *Continuous Concrete Bridges.* P.C.A.

A.R.E.A. *Manual for Railway Engineering.* 1970.

B.C.S.A. *Simply Supported Bridges in Composite Construction BD2.* 1970.

Blodgett, D. *Design of Welded Structures.* Lincoln, 1968.

Clowes, E. J. ed. *Manual of Bridge Design Practice,* 3rd ed. State of Calif., Highway Transp. Agency, 1971.

O'Connor, C. *Design of Bridge Superstructures.* Wiley, 1971.

Rowe, R. E. *Concrete Bridge Design.* C.R.B., 1963.

Somervaille, G. & Tiller, R. M. *Standard Bridge Beams from 7m to 36m.* C. & C.A.

Viest, I. M., Fountain, R. S. & Singleton, R. C. *Composite Construction in Steel and Concrete for Bridges and Buildings.* McGraw-Hill, 1958.

8.014 Computer Applications in Civil Engineering

Pre- or co-requisites: 8.153/8.532.

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

TEXTBOOKS

Cole, R. W. *Introduction to Computing.* McGraw-Hill.

Peterson, W. W. & Holz, J. L. *Fortran IV and The IBM 360.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Bates, F. & Douglas, M. L. *Programming Language One.* Prentice-Hall.

Blatt, J. M. *Introduction to Fortran IV Programming.* Goodyear.

8.015 Road Engineering

Pre- or co-requisite: 8.631.

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

Pre- or co-requisite: 8.532.

Use of hydraulic models for rivers and coastal works. Further studies in open channel flow and estuarine hydraulics.

8.017 Transportation Engineering

PRINCIPAL REFERENCE BOOKS

Ashton, W. D. *Theory of Traffic Flow.* Methuen, 1966.

Blainey, G. *The Tyranny of Distance: How Distance Shaped Australia's History.* Sun Books, 1968.

Blunden, W. R. *Land-Use/Transport System: Analysis and Synthesis.* Pergamon, 1971.

Potts, R. B. & Oliver, R. M. *Flows in Transportation Networks.* Academic. 1972.

8.018 Construction Engineering

Pre- or co-requisite: 8.631.

Advanced construction methods and techniques with special reference to major civil engineering projects under construction in Australia.

8.019 Railway Engineering

Not compatible with 8.013. Pre- or co-requisite: 8.631.

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

Pre- or co-requisite: 8.532.

Flood estimation with particular reference to design and flood forecasting. Outline of current practices and recent developments. Discussion of possible/likely implications of recent developments for the practising engineer.

8.021 Environmental Aspects of Civil Engineering

An interdisciplinary study of the possible aesthetic and ecological effects of civil engineering activities on the environment.

TEXTBOOKS

Meadows, D. H. et al. *The Limits to Growth.* Earth Island, 1972.

PRINCIPAL REFERENCE BOOKS

Detwyler, T. R. *Man's Impact on Environment.* McGraw-Hill, 1971.

Mumford, L. *The City in History.* Secker & Warburg, 1961.

Odum, E. P. *Fundamentals of Ecology.* 3rd ed. Saunders, 1971.

8.022 Elasticity and Plasticity

Pre- or co-requisite: 8.153.

Aspects of the elasticity and plasticity theories to solution of stress distribution and stability problems.

8.023 Hydrodynamics

Prerequisites: 8.571, 10.022.

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

PRINCIPAL REFERENCE BOOK

Vallentine, H. R. *Applied Hydrodynamics.* Butterworths, 1969.

8.024 Foundation and Dam Engineering

Pre- or co-requisites: 8.253.

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

Pre- or co-requisite: 8.253.

Case studies of significant structural failures and distress during concept, construction, design and use. Modes, causes, consequences, responsibilities, corrective procedures.

8.026 Systems Methods in Civil Engineering

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 course.

8.027 New Materials I

Trends in materials development in 20th century; historical review, projected trends. Mechanisms of material strengthening; emphasis of strength, stiffness, significance of fracture toughness, durability. Utilization of waste products as constructional materials; fly ash.

8.028 New Materials II

Introduction to polymers, methods of formation, types, properties, fabrication. Design with thermoplastics. Reinforced plastics, properties, fabrication, application. Design with reinforced plastics. Timber; plywood, glulam, stress grading.

8.029 Continuum Mechanics.

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.

PRINCIPAL REFERENCE BOOKS

Fung, Y. C. *A First Course in Continuum Mechanics.* Prentice-Hall.

Eringen, A. C. *Mechanics of Continua.* Wiley.

Prager, W. *Introduction to Mechanics of Continua.* Dover, 1973.

Truesdell, C. *The Elements of Continuum Mechanics.* Springer-Verlag, 1966.

Sedov, L. V. *Introduction to the Mechanics of Continuous Medium.* Addison-Wesley, 1965.

8.030 Construction Management

Civil Engineering Construction organization, management and control.

8.031 Construction Project Finance

Civil Engineering construction project feasibility, financial management, cash flow, cost control, insurance and company finance.

8.032 Law for Builders

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

Introduction to industrial law, including reference to Commonwealth and State statutory provisions dealing with conciliation and arbitration. State and Commonwealth awards. Industrial disputes. Employers' associations. Trade unions. Introduction to real property and local government law.

8.034 Engineering Economy

Economic evaluation of civil engineering projects, including benefit-cost analysis and rate of return analysis.

8.035 Flat Slab Design

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

Definition and history of the limit state method of structural design. Probabalistics and semi-probabalistic approaches. Limiting criteria. Limit state codes. Application to bridges and buildings.

8.037 Optimum Design of Structures

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 Special Topics in Reinforced Concrete Design

Brief discussion of analysis and design of tall buildings, flat slabs and flat plates, thin shell roofs, water-retaining structures, staircases, members in torsion, deep beams.

8.039 Computer Programming

Introduction to FORTRAN Programming, use of WATFIV compilers, flow charts and simple problems.

8.040 Advanced Engineering Geology

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

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

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

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

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

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

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

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

Final year design projects in the fields of structural engineering and civil engineering materials.

8.052 Design Projects II

Final year design projects in the fields of hydraulics, water resources, planning and management.

8.112 Materials and Structures

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.

PRINCIPAL REFERENCE BOOKS

Davis, H. E., Troxell, G. E. & Wiskocil, G. T. *Testing and Inspection of Engineering Materials.* McGraw-Hill.

Hall, A. S. *Mechanics of Solids.* Wiley, 1968.

Lancaster, P. R. & Mitchell, D. *The Mechanics of Materials.* McGraw-Hill.

Richards, C. W. *Engineering Materials Science.* Chapman & Hall.

Shanley, F. R. *Strength of Materials.* McGraw-Hill.

8.113 Civil Engineering

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. Deflection 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., Troxell, 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.

PRINCIPAL REFERENCE BOOK

Richards, C. W. *Engineering Materials Science.* Chapman & Hall.

8.151 Mechanics of Solids

Statics of bars. Geometrical properties of plane figures. Stress and strain; uniaxial stress. Stresses and deformations due to bending, shear and torsion. Stress and strain at a point; combined stresses. Assemblages of bars and beams. Structural instability. Dynamic loading.

TEXTBOOK

Hall, A. S. *Introduction to the Mechanics of Solids.* SI ed. Wiley, 1973.

PRINCIPAL REFERENCE BOOKS

Popov, E. P. *Introduction to Mechanics of Solids.* Prentice-Hall.

Shanley, F. R. *Strength of Materials.* McGraw-Hill.

Smith, J. O. & Sidebottom, O. M. *Elementary Mechanics of Deformable Bodies,* Macmillan.

8.152 Structures

(a) *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.

(b) *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 equation 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 Code CA 2 1973 "Concrete in Buildings".

(c) *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 mechanisms with linear material response. Discussion of the 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, 1971.

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.*

PRINCIPAL REFERENCE BOOKS

Bresler, B., Lin, T. Y. & Scalzi, J. B. *Design of Steel Structures.* 2nd ed. Wiley, 1968.

Ferguson, P. M. *Reinforced Concrete Fundamentals.* Wiley.

8.153 Structures

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 their 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 slab design.

TEXTBOOK

A.S. *Code* CA35 – 1973.
A.S. *Code* CA65 – 1972.

PRINCIPAL REFERENCE BOOKS

Analysis

Inst. Struct. Engr. *Code of Practice No. 2.* 1951. *Earth Retaining Structures.*
Laursen, H. I. *Structural Analysis.* McGraw-Hill, 1969.
Livesley, R. K. *Matrix Methods of Structural Analysis.* Pergamon, 1964.
Neal, B. G. *The Plastic Methods of Structural Analysis.* 2nd ed. Chapman & Hall, 1965.

Design

Beedle, L. S. *Plastic Design of Steel Frames.* Wiley.
Bresler, B., Lin, T. Y. & Scalzi, J. B. *Design of Steel Structures.* Wiley, 1968.
Ferguson, P. M. *Reinforced Concrete Fundamentals.* Wiley.
Lin, T. Y. *Design of Prestressed Concrete Structures.* Wiley.
Pearson, R. G. et al. *Timber Engineering Design Handbook.* M.U.P.
Winter, G., Urquhart, L. C., O'Rourke, C. E. & Nilson, A. H. *Design of Concrete Structures.* 7th ed. McGraw-Hill, 1964.

8.154 Structures

Analysis. The principle of virtual work. Statics. Flexibility analysis of simple frames. Plastic analysis of steel frames. Stiffness analysis of trusses and frames.

TEXTBOOK

White, R. N., Gergely, P. & Sexsmith, R. G. *Structural Engineering.* Vol. 2: *Intermediate Structures.* Wiley.

PRINCIPAL REFERENCE BOOKS

Laursen, H. I. *Structural Analysis.* McGraw-Hill, 1969.
Livesley, R. K. *Matrix Methods of Structural Analysis.* Pergamon, 1964.
Martin, H. C. *Introduction to Matrix Methods of Structural Analysis.* McGraw-Hill.
Neal, B. G. *The Plastic Methods of Structural Analysis.* 2nd ed. Chapman & Hall, 1965.

Design of Structures. As for 8.153.

PRINCIPAL REFERENCE BOOKS

As for 8.153.

8.161 Engineering Mathematics

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

Ketter, R. L. & Prawel S. P. Jr., *Modern Methods of Engineering Computation.* McGraw-Hill, 1969.

PRINCIPAL REFERENCE BOOKS

Calderbank, V. J. *A Course in Programming in Fortran IV.* Chapman & Hall *and* Science Paperbacks, 1969.

Freund, J. E. *Mathematical Statistics.* Prentice-Hall, 1962.

Guttman, I. & Wilks, S. S. *Introductory Engineering Statistics.* Wiley, 1965.

McCracken, D. D. & Dorn, W. S. *Numerical Methods & Fortran Programming.* Wiley, 1964.

McCormick, J. M. & Salvadori, M. G. *Numerical Methods in Fortran.* Prentice-Hall, 1964.

Walpole, R. E. *Introduction to Statistics.* Macmillan, 1968.

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 Mechancis of Solids.* SI ed. Wiley, 1973.

8.172 Mechanics of Solids II

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, 1973.

PRINCIPAL REFERENCE BOOKS

Popov, E. P. *Introduction to Mechanics of Solids.* Prentice-Hall.

Shanley, F. R. *Strength of Materials.* McGraw-Hill.

Smith, J. O. & Sidebottom, O. M. *Elementary Mechanics of Deformable Bodies.* Macmillan.

8.173 Structural Analysis I

Aims of structural analysis. Virtual work: contragredience in scalar form. Forces and deformation of statically determinate trusses. Flexibility analysis of indeterminate trusses. Moment distribution. Influence lines. Concept of volume integrals. Forces and deformation of statically determinate rigid-jointed structures. Flexibility analysis.

TEXTBOOK

White, R. N., Gergely, P. & Sexsmith, R. G. *Structural Engineering.* Vol. 1. *Introduction to Design Concepts and Analysis.* pp. 1-260. Wiley, 1972.

8.174 Structural Analysis II

Plastic analysis of steel structures. Variational forms of the work theorems. Force and displacement transformations. Contragredience in matrix form. Maxwell-Betti theorem. Stiffness analysis of trusses. Stiffness analysis of frames.

8.181 Structural Design I

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.

PRINCIPAL REFERENCE BOOKS

Gerstle, K. H. *Basic Structural Design.* McGraw-Hill, 1967.

Morgan, W. *The Elements of Structures.* Pitman, 1968. Paperback.

Salvadori, M. & Heller, R. *Structure in Architecture.* Prentice-Hall, 1963.

8.182 Structural Design II

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.

PRINCIPAL REFERENCE BOOKS

Bresler, B., Lin, T. Y. & Scalzi, J. B. *Design of Steel Structures.* Wiley, 1968.

Gerstle, K. H. *Basic Structural Design.* McGraw-Hill, 1967.

Pearson, R. G., et al. *Timber Engineering Design Handbook.* M.U.P.

Winter, G. & Nilson, A. H. *Design of Concrete Structures,* 8th ed. McGraw-Hill, 1972.

8.191 Structural Engineering

(a) Dynamic analysis. Cable structures. Plates and shells. Finite elements.
(b) 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

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, 1966.

PRINCIPAL REFERENCE BOOKS

Davis, H. E., Troxell, G. E., & Wiskocil, G. T. *Testing and Inspection of Engineering Materials.* McGraw-Hill.

Mann, J. Y. *Fatigue of Materials.* M.U.P.

Marin, J. *Mechanical Behaviour of Engineering Materials.* Prentice-Hall, 1962.

Richards, C. W. *Engineering Materials Science.* Chapman & Hall.

Wyatt, O. & Dew-Hughes, D. *Metals, Ceramics, and Polymers.* C.U.P.

8.252 Civil Engineering Materials

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, 1969.

Troxell, G. E., Davis, H. E., & Kelly, J. W. *Composition and Properties of Concrete.* 2nd ed. McGraw-Hill, 1968.

or

Neville, A. *Properties of Concrete.* Pitman.

PRINCIPAL REFERENCE BOOKS

Akroyd, T. N. W. *Concrete Properties and Manufacture.* Pergamon, N.Y., 1962.

A.S.T.M. Standards, Part 10. Concrete and Mineral Aggregates. Amer. Soc. for Testing Materials (revised annually in Oct.) Philadelphia.

Bishop, A. W. & Henkel, D. J. *The Measurement of Soil Properties in the Triaxial Test.* Arnold.

BSI Specification (current editions) *B.S12 Portland Cement (Ordinary and Rapid Hardening); B.S812 Sample and Testing of Mineral Aggregates, Sands and Fillers; B.S882 Concrete Aggregates from Mineral Sources; B.S1881 Methods of Testing Concrete.* Br. Stand. Instit. London.

Concrete Manual. U.S. Bureau of Reclamation.

Design, Control and Characteristics of Concrete. Cement & Concrete Association of Australia.

Fulton, F. S. *Concrete Technology.* Portland Cement Instit. Johannesburg, 1964.

Robson, T. D. *High Alumina Cements and Concretes.* Contractors Record 1962, London.

S.A.A. Code CA2 Concrete in Buildings. Stand. Assoc. of Aust. (incl. 1968 amendments).

S.A.A. Specifications (current editions) *A2 Portland Cement; A64 Ready Mixed Concrete; A167-170 Aggregates for Concrete; A100-A113 Methods of Testing Portland Cement Concrete; A130 Los Angeles Test for Coarse Aggregate.* Stand. Assoc. of Aust.

Soil Mechanics for Road Engineers. H.M.S.O.

Taylor, W. H. *Concrete Technology and Practice.* 3rd ed. A. & R.

Terzaghi, K. *Theoretical Soil Mechanics.* Wiley.

Terzaghi, K. & Peck, R. B. *Soil Mechanics in Engineering Practice.* 2nd ed. Wiley, 1967.

8.253 Civil Engineering Materials

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 site 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.

PRINCIPAL REFERENCE BOOKS

A.C.I. *Manual of Concrete Practice.* 3 vols. 1968.

A.S.T.M. Standards, Part 10. *Concrete and Mineral Aggregates.* Amer. Soc. for Testing Materials (revised annually in Oct.), Philadelphia.

Beuche, F. *Physical Properties of Polymers.* Wiley.

Bishop, A. W., & Henkel, D. J. *The Measurement of Soil Properties in the Triaxial Test.* Arnold.

Concrete Manual. U.S. Bureau of Reclamation.

Desch, H. E. *Timber, Its Structures and Uses.* 3rd ed. Macmillan.

Lee, I. K. ed. *Soil Mechanics – Selected Topics.* Butterworths.

Lee, I. K. ed. *Soil Mechanics – New Horizons.* Butterworths.

S.A.A. Codes A64, A77, A100-A111, A89, CA2-1973.

8.254 Civil Engineering Materials

Part 1 – 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.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 8.253.

8.259 Properties of Materials

8.250 Properties of Materials, *plus* the structure and properties of binary alloys; control of structure and properties, commercial alloys, materials selection.

TEXT AND PRINCIPAL REFERENCE BOOKS

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 Civil Engineering Materials I

Crystal structures, planes and directions. Examinations of crystals by X-ray, electron and neutron diffraction techniques. Defects. Properties of metals and metallic alloys in terms of modern theories. Development of alloys for specific engineering applications. Structure and chemistry of polymers including wood. Structure of silicates. Clays. Cement. Chemistry of cements. Formation, structure and classification of rocks and soils. Geotechtonics and structural geology. Structural characteristics, and mapping. Use of petrological microscope. Interpretation of mechanical properties on basis of structure of materials.

TEXTBOOKS

Houldcroft, P. T. *Welding Processes.* C.U.P.

Polakowski, N. H. & Ribling, E. J. *Strength and Structure of Engineering Materials.* Prentice-Hall, 1966.

or

McClintock, F. A. & Argon, A. S. *Mechanical Behaviour of Materials.* Addison-Wesley.

Wyatt, O. H. & Dew-Hughes, D. *Metals Ceramics and Polymers.* C.U.P.

PRINCIPAL REFERENCE BOOKS

Jastrzebski, D. *Nature and Properties of Engineering Materials.* Wiley Toppan.

Keyser, C. A. *Materials Science Engineering.* Merrill.

Ruoff, A. L. *Introduction to Materials Science.* Prentice-Hall.

Clark, D. S. & Varney, W. R. *Physical Metallurgy for Engineers.* Van Nostrand Reinhold.

8.273 Civil Engineering Materials II

Failure theories for ductile and brittle materials. Rheological models of

stress-strain-time behaviour. Statistical concepts applied to interpretation and prediction of material behaviour. Welding processes. Equipment. Welding Metallurgy. Shrinkage and distortion. Residual stresses. Weld specifications. Stability analysis of foundation, rigid and flexible retaining walls, earth and rock slopes. Settlement studies of isolated footings, piles and raft foundations. Earth and rock fill dams. Site investigations. Application of statistics to geotechnical engineering. Types of components. Reinforcement. Mechanical properties. Developments in components.

TEXTBOOKS

Lambe, T. W. & Whitman, R. V. *Soil Mechanics.* Wiley.

or

Bowles, J. E. *Foundation Analysis and Design.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Alexander, J. M. & Brewer, R. C. *Manufacturing Properties of Materials.* Van Nostrand.

Bowles, J. E. *Analytical and Computer Methods in Foundation Engineering.* McGraw-Hill.

Reed-Hill, R. E. *Physical Metallurgical Principles.* Van Nostrand.

Terzaghi, K. V. & Peck, R. B. *Soil Mechanics in Engineering Practice.* Wiley.

Wu, T. H. *Soil Mechanics.* Allyn & Bacon.

8.274 Civil Engineering Materials III

Fracture mechanics, specification of materials, field control. Corrosion of metallic and non-metallic materials. Fatigue. Properties of concrete. Structure and composition. Rheological models of fresh concrete. Mix design. Additives. Multi-phase theory of elastic behaviour. Bond. Creep. Shrinkage. Physical and chemical deterioration. Permeability. Non-destructive testing. Mechanical and physical properties of reinforced polymers. Principles of adhesives. Bond. Properties of timber.

TEXTBOOK

Neville, A. M. *Properties of Concrete.* Pitman.

PRINCIPAL REFERENCE BOOKS

ASTM Standards. *Part 10. Concrete and Mineral Aggregates.* ASTM.

Concrete Manual. U.S. Bureau Reclamation.

Dosch, H. E. *Timber, Its Structure and Uses.* Macmillan.

Manual of Concrete Practice. 3 vols. A.C.I. 1968.

Murdock, L. T. & Blackledge, G. F. *Concrete Materials and Practice.* 4th ed. Arnold.

S.A.A. Specifications A64, A77, A100-A111, CA2.

8.301 Systems Engineering

Covers the following topics: Systems approach. Basic systems concepts. State space analysis. Concepts of linearity, non-linearity, equilibrium, stability. Modelling and simulation. Deterministic and stochastic system models. Decision theory. Optimization techniques. Linear programming. Dynamic programming. Applications.

TEXTBOOK

Meredith, D. D., Wong, K. W., Woodhead, R. W. & Wortman, R. H. *Design & Planning of Engineering Systems.* Prentice-Hall, 1973.

PRINCIPAL REFERENCE BOOKS

de Neufville, R. & Stafford, J. *Systems Analysis for Engineers and Managers.* McGraw-Hill, 1971.

Wagner, H. M. *Principles of Operations Research.* Prentice-Hall.

8.351 Engineering Mathematics

As for 8.161 Engineering Mathematics.

8.510 Hydraulics

Fluid properties; hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations. Laboratory experiments.

TEXTBOOKS

Giles, R. V. *Fluid Mechanics and Hydraulics.* Schaum's Outline Series. Schaum, N.Y.

Vennard, J. K. *Elementary Fluid Mechanics.* 4th ed. Wiley, 1961.

PRINCIPAL REFERENCE BOOK

Vallentine, H. R. *Water in the Service of Man.* Penguin, 1967.

8.531 Water Engineering

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, steamgauging, 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 past 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, N.Y.

Nemec, J. *Engineering Hydrology.* McGraw-Hill, 1972.

Tebbutt, T. H. Y. *Principles of Water Quality Control.* Pergamon, 1971.

Vennard, J. K. *Elementary Fluid Mechanics.* 4th ed. Wiley, 1961.

PRINCIPAL REFERENCE BOOKS

Behr, *L. C., Fuson, R. C. & Snyder, H. A.* A Brief Course in Organic Chemistry. Wiley, 1959.

Bruce, J. P. & Clark, R. H. *Introduction to Hydrometeorology.* Pergamon, 1966.

Chow, V. T. ed. *Handbook of Applied Hydrology.* McGraw-Hill, 1964.

Hardenbergh, W. A. & Rodie, E. R. *Water Supply and Waste Disposal.* Internat. Textbook Co., Pa., 1961.

Henderson, F. M. *Open Channel Flow.* Macmillan.
Johnstone, D. & Cross, W. P. *Elements of Applied Hydrology.* Ronald, 1949.
Linsley, R. K. & Franzini, J. B. *Water Resources Engineering.* 3nd ed. McGraw-Hill-Kogahuska, 1972.
Linsley, R. K. Kohler, M. A. & Paulhus, J. L. *Hydrology for Engineers.* McGraw-Hill, 1958.
Murray, P. D. F. *Biology.* Macmillan, 1954.
Stepanoff, A. J. *Axial and Centrifugal Pumps.* Wiley.
Vallentine, H. R. *Applied Hydrodynamics.* Butterworths, 1967.
Wisler, C. O. & Brater, E. F. *Hydrology.* 2nd ed. Wiley, 1959.

8.532 Water Engineering

Part I – Hydraulics: Unsteady Flow: pendulation and surge tank, water hammer in branching lines, waves in frictionless channels, solitary, periodic 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, 1961.

PRINCIPAL REFERENCE BOOKS

Charts for the Design of Channels. Hydraulics Research Paper No. 2. H.M.S.O.
Chow, V. T. ed. *Handbook of Applied Hydrology.* McGraw-Hill.
Chow, V. T. *Open Channel Hydraulics.* McGraw-Hill.
Henderson, F. M. *Open Channel Flow.* Macmillan.
Linsley, R. K. & Franzini, J. B. *Water Resources Engineering.* McGraw-Hill, 1964.
Raudkivi, A. J. *Loose Boundary Hydraulics.* Pergamon.
Resistance of Fluids in Channel Pipes. Hydraulics Research Paper No. 1. H.M.S.O.
Robertson, J. M. *Hydrodynamics.* Prentice-Hall.
Rouse, H. ed. *Engineering Hydraulics.* Wiley.
Streeter, V. L. & Wylie, E. B. *Hydraulic Transients.* McGraw-Hill.
Vallentine, H. R. *Applied Hydrodynamics.* Butterworths, 1967.

8.571 Hydraulics I

Fluid properties: hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 8.510.

8.572 Hydraulics II

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.

TEXT AND PRINCIPAL REFERENCE BOOKS
As for 8.510.

8.573 Hydraulics III

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.

TEXT AND PRINCIPAL REFERENCE BOOKS
As for 8.510.

8.581 Water Resources I

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, 1971.

8.582 Water Resources II

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.

PRINCIPAL REFERENCE BOOKS

Bruce, J. P. & Clark, R. H. *Introduction to Hydrometeorology.* Pergamon, 1966.

Chow, V. T. ed. *Handbook of Applied Hydrology.* McGraw-Hill, 1964.

Linsley, R. K. & Franzini, J. B. *Water Resources Engineering.* 2nd ed. McGraw-Hill-Kogahuska, 1972.

Linsley, R. K., Kohler, M. A. & Paulhus, J. L. *Hydrology for Engineers.* McGraw-Hill, 1958.

8.583 Water Resources III

Hydraulics of groundwater systems, application to regional problems. Water resources planning, systems approach, applied aspects of water engineering.

8.621 Engineering Construction

Construction plant and equipment; compressed air services, drilling, earth-moving, tunnelling and blasting, hoisting and conveying, pile-driving, etc.: aggregate and concrete plant. Principles of construction administration; evolution of management; objectives of management; principles of organisation; motivation and communication; project management. The role of government and local government authorities. An introduction to construction planning and scheduling;

cost control and cost accounting; tenders and the preparation of estimates; scheduling of operations; linear programming, critical path and PERT techniques; contracts and specifications.

TEXTBOOKS

Antill, J. M. & Ryan, P. W. S. *Civil Engineering Construction.* 4th ed. A. & R.

Peurifoy, R. L. *Construction, Planning, Equipment and Methods.* 2nd ed. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Allen, L. *Management and Organisation.* McGraw-Hill, 1958.

Antill, J. M. *Civil Engineering Management.* A. & R.

Antill, J. M. & Woodhead, R. *Critical Path Methods in Construction Practice.* McGraw-Hill.

Linsley, R. K. & Franzini, J. B. *Water Resources Engineering.* McGraw-Hill.

O'Neill, L. V. *Fundamentals of Estimating and Construction Cost Control.* Tait.

8.631 Civil Engineering

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 relationships (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 intercharges, 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 Introduction to Engineering Construction

This subject forms part of 5.030 Engineering C.

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.

PRINCIPAL REFERENCE BOOKS

Antill, J. M. & Ryan, P. W. S. *Civil Engineering Construction.* 4th ed. A. & R.

Pannell, A. N. *History of Civil Engineering.* Wiley.

Peurifoy, R. L. *Construction Planning, Equipment and Methods.* 2nd ed. McGraw-Hill.

8.671 Engineering Construction

Role of the construction engineer; site services and site works; plant and equipment; clearing, earthmoving, drilling, blasting, quarrying, tunneling, pile-driving, hoisting, conveying; setting out, quantity surveys; scheduling of operations, estimating, costing, practical examples of construction of dams, bridges, tunnels, buildings and roadworks.

8.672 Planning and Management I

Elements of engineering economics, project costs and benefits; interest, present worth, annual cost, rates of return, economic comparisons, benefit/cost analysis, project evaluation.

Principles of management; management techniques, linear programming, critical path methods, inventory management. Project objectives, feasibility studies, investigation, design alternatives, environmental impact assessment; estimation of construction costs.

8.673 Planning and Management II

Construction contracts; drawings, specification and quantities; project organization, financial control and costing, construction management; personnel management, industrial relations; professional responsibilities. Technical communication. Engineering planning aspects of regional and urban developmental works, transportation and traffic and highway engineering.

8.711 Engineering for Surveyors I

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, 1961.

PRINCIPAL REFERENCE BOOKS

Bass, W. Skurlow, J. *Introduction to Hydraulics.* rev. Institution of Surveyors, N.S.W. Div.

Bruce, J. P. & Clark, R. H. *Introduction to Hydrometeorology.* Pergamon, 1966.

Linsley, R. K., Kohler, M. A. & Paulhus, J. L. H. *Hydrology for Engineers.* McGraw-Hill, 1958.

Nemec, J. *Engineering Hydrology.* McGraw-Hill, 1972.

Stormwater Standards Committee. *Australian Rainfall and Runoff.* Inst. of Engineers, Australia.

• 8.712 Engineering for Surveyors II

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., 1967.

PRINCIPAL REFERENCE BOOKS

Asher, S. J. *Water Supply and Main Drainage.* Crosby Lockwood, 1961.

Capper, P. L., Cassie, W. F. & Geddes, J. D. *Problems in Engineering Soils.* Barnes & Noble, 1966.

Scott, R. F. *Principles of Soil Mechanics.* Addison-Wesley, 1963.

Stace, H. C. T. *Handbook of Australian Soils.* Rellim Tech. Pubs., 1968.

Taylor, D. W. *Fundamentals of Soil Mechanics.* Wiley, 1960.

Tebbutt, T. H. Y. *Principles of Water Quality Control.* Pergamon, 1971.

•8.713 Management for Surveyors

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.

DEPARTMENT OF INDUSTRIAL ENGINEERING

18.011 Industrial Engineering IA

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. Combined stresses, yield criteria, introduction to plasticity theory. *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. *Aspects of Machine Tool Design and Utilization:* Structural stiffness, drive-trains, slideways. Causes of chatter. Factors affecting the selection and use of machine tools.

TEXTBOOK

Alexander, J. M. & Brewer, R. C. *Manufacturing Properties of Materials.* Van Nostrand, 1963.

PRINCIPAL REFERENCE BOOKS

Armarego, E. J. A. & Brown, R. H. *The Machining of Metals.* Prentice-Hall, 1969.

Backofen, W. A. *Deformation Processing.* Addison-Wesley, 1972.

Boothroyd, G. *Fundamentals of Metal Machining.* Arnold, 1965.

Dieter, G. D. *Mechanical Metallurgy.* Int. ed. McGraw-Hill, 1961.

Rowe, G. W. *The Principles of Metalworking.* Arnold, 1968.

Thomas, G. G. *Production Technology.* O.U.P., 1970.

18.012 Industrial Engineering IIA

Prerequisites: 5.112, 18.011.

Technology of Manufacturing: Basic plasticity theory. Theories of deformation processes, extrusion, tube making, forming and deep drawing. *Design for Production:* Interchangeable manufacture; standardisation; design communication; pre-production planning; introduction to design analysis. *Metrology:* Principles of measurement and measuring systems; basic design concepts of mechanical, optical, pneumatic and electrical systems, linear and angular measurements; straightness and flatness; screw thread measurements; machine tool testing.

TEXTBOOKS

A.S. CZ-1. 1973. *Engineering Drawing Practice.*

BS 4500-1969. *ISO Limits & Fits.*

Gladman, C. A. *Geometric Analysis of Engineering Designs.* Aust. Trade Pub., 1966.

Johnson, W. & Mellor, P. B. *Engineering Plasticity.* Van Nostrand. 1973.

Scarr, A. J. T. *Metrology and Precision Engineering.* McGraw-Hill, 1967.

PRINCIPAL REFERENCE BOOKS

Alexander, J. M. & Brewer, R. C. *Manufacturing Properties of Materials.* Van Nostrand, 1963.

Hoffman, O. & Sachs, G. *Introduction to the Theory of Plasticity for Engineers.* McGraw-Hill, 1953.

Hume, K. J. *Engineering Metrology.* 2nd ed. Macdonald.

Rowe, G. W. *An Introduction to the Principles of Metalworking.* Arnold. 1968.

18.021 Industrial Engineering IB

Prerequisite: 10.022. Co- or prerequisite: 5.071

Engineering Economy: Price-output decisions under various competitive conditions. The time-value of money, nett 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, e.g. replacement, capital rationing. Measures of profitability. *Industrial Applications of Probability* – Tutorial problems from the fields of sampling inspection, quality control, control charts – simple economic models, e.g. newsboy-problem, length of steel bars.

TEXTBOOKS

Burr, I. W. *Engineering Statistics and Quality Control.* McGraw-Hill, 1953.

Smith, G. W. *Engineering Economy.* Iowa State U.P., 1968.

PRINCIPAL REFERENCE BOOKS

Duncan, A. J. *Quality Control and Industrial Statistics.* Irwin, 1959.

Grant, E. L. *Statistical Quality Control.* Int. ed. McGraw-Hill, 1964.

Moroney, M. J. *Facts from Figures.* Penguin, 1965.

Paradine, C. G. & Rivett, B. H. P. *Statistical Methods for Technologists.* English U.P., 1966.

Samuelson, P. A., Hancock, K. & Wallace, R. *Economics.* Aust. ed. McGraw-Hill, 1970.

18.022 Industrial Engineering IIB

Prerequisites: 5.071, 18.021.

Design of Manufacturing Facilities – Product and objectives, equipment selection. Charting and systematic improvement of methods, 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.

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.

Industrial Psychology – Individual differences, operator selection and learning, motivation to work, conflict and frustration, social aspects of industry.

TEXTBOOKS

Brown, J. A. C. *The Social Psychology of Industry.* Penguin, 1964.

Buffa, E. S. *Modern Production Management.* 4th ed. Wiley, 1973.

PRINCIPAL REFERENCE BOOKS

Carson, G. B. ed. *Production Handbook.* 2nd ed. Ronald, 1958.

Greene, J. H. *Production Control Systems and Decisions.* Irwin, 1965.

Maynard, H. B. ed. *Industrial Engineering Handbook.* 2nd ed. McGraw-Hill, 1963.

Moore, F. G. *Production Control.* Int. ed. McGraw-Hill, 1959.

Moore, J. M. *Plant Layout and Design.* Macmillan, 1962.

Murrell, K. F. H. *Ergonomics.* Chapman & Hall, 1965.

Niebel, B. W. *Motion and Time Study.* 4th ed. Irwin, 1967.

18.121 Production Management

Prerequisites: 10.031, 10.331.

Engineering Economics – The structure of the Australian economy. The theory of the firm, pricing, fluctuations in demand. The economics of 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, 1973.

Lu, F. P. S. *Economic Decision-making for Engineers and Managers.* Whitcomb & Tombs, 1969.

Moore, P. G. *Basic Operational Research.* Pitman, 1968.

PRINCIPAL REFERENCE BOOKS

Barnes, R. M. *Motion and Time Study.* 6th ed. Wiley, 1968.

Greene, J. H. *Production Control Systems and Decisions.* Irwin, 1965.

Hillier, F. S., & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1968.

Smith, G. W. *Engineering Economy.* Iowa State U.P., 1968.

18.431 Design for Production

Prerequisites: 18.011, 5.112. Co- or prerequisite: 18.012

Interchangeable manufacture; standardisation; unit and selective assembly; preferred sizes. Presentation and interpretation of geometric tolerances; grouping: analysis of non-linear loop equations, economic allocation of tolerances; application of probability theory to tolerance allocation. Gauge design: effect of gauge tolerances on interchangeability.

TEXTBOOKS

A.S. CZ-1. 1973. *Engineering Drawing Practice.*

B.S. 4500: 1969. *Limits and Fits.*

Gladman, C. A. *Geometric Analysis of Engineering Designs.* Aust. Trade Pub., 1966.

PRINCIPAL REFERENCE BOOK

Parker, S. *Drawings and Dimensions.* Pitman, 1956.

18.551 Operations Research

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, 1971.

PRINCIPAL REFERENCE BOOKS

Gass, S. I. *Linear Programming.* 2nd ed. McGraw-Hill, 1964.

Hadley, G. *Linear Programming.* Addison-Wesley, 1969.

Hanssmann, F. *Operations Research in Production and Inventory Control.* Wiley, 1962.

Hillier, F. S. & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1967.

Houlden, B. T. ed. *Some Techniques of Operational Research.* E.U.P., 1962.

Moder, J. J. & Phillips, C. R. *Project Management with CPM and PERT.* Van Nostrand, 1964.

Simmons, D. M. *Linear Programming for Operations Research.* Holden-Day, 1972.

SCHOOL OF NUCLEAR ENGINEERING

23.051 Nuclear Power Technology

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, thermomechanical performance of fuel pins and pressure vessels.

PRINCIPAL REFERENCE BOOKS

Semat, H. & Albright, A. R. *Introduction to Atomic and Nuclear Physics.* 5th ed. Chapman & Hall, 1972.

Glasstone, S. & Sesonske, A. *Nuclear Reactor Engineering.* Van Nostrand, 1963.

El-Wakil, M. M. *Nuclear Power Engineering.* McGraw-Hill, 1962.

Nuclear Energy Costs and Economic Development. International Atomic Energy Agency, 1970.

SCHOOL OF SURVEYING

29.001 Surveying IA

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, 1958.

Whyte, W. S. *Revision Notes on Plane Surveying.* Newnes-Butterworth.

PRINCIPAL REFERENCE BOOKS

Clark, D. *Plane and Geodetic Surveying.* Vol. I. 6th ed. Constable, 1969.

Mitchell, H. C. *Definition of Terms used in Geodetic and other Surveys,* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

29.002 Surveying IB

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 29.001 Surveying IA.

29.102 Surveying II

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

Allan, A. L., Hollwey, J. R. & Maynes, J. H. B. *Practical Field Surveying and Computations.* Heinemann.

Burnside, C. D. *Electromagnetic Distance Measurement.* Crosby Lockwood, 1971.

Clark, D. *Plane and Geodetic Surveying.* Vol. I. 6th ed. Constable, 1969.

Cooper, M. A. R. *Modern Theodolites and Levels.* Crosby Lockwood, 1971.

Smith, J. R. *Optical Distance Measurement.* Crosby Lockwood, 1971.

PRINCIPAL REFERENCE BOOKS

Admiralty Manual of Hydrographic Surveying. Vol. I. *Surveying on Shore.* Hydrographic Dept. of the Navy, London, 1965.

Clark, D. *Plane and Geodetic Surveying.* Vol. II. 5th ed. Constable, 1963.

Mitchell, H. C. *Definitions of Terms used in Geodetic and other Surveys.* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

Sandover, J. A. *Plane Surveying.* Arnold, 1961.

29.103 Surveying III

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

Burnside, C. D. *Electromagnetic Distance Measurement.* Crosby Lockwood, London, 1971.

Clark, D. *Plane and Geodetic Surveying.* Vol. I. 6th ed. Constable, 1969.

Cooper, M. A. R. *Modern Theodolites and Levels.* Crosby Lockwood, 1971.

Smith, J. R. *Optical Distance Measurement.* Crosby Lockwood, 1971.

PRINCIPAL REFERENCE BOOKS

Clendinning, J., & Olliver, J. G. *Principle and Use of Surveying Instruments.* 3rd ed. Blackie, 1969.

Hardy, A. C. & Perrin, F. H. *The Principles of Optics.* McGraw-Hill, 1956.

International Association for Geodesy. *Symposium on Electromagnetic Distance Measurement.* Hilgar & Watts, Oxford, 1965.

Laurila, S. H. *Electronic Surveying and Mapping.* 2nd ed. Farrar, 1967.

Mitchell, H. C. *Definitions of Terms used in Geodetic and other Surveys.* U.S. Coast and Geodetic Survey Sp. Pub. 242, 1948.

Richardus, P. *Project Surveying.* North Holland, 1966.

Saastamoinen, J. J. ed. *Surveyors Guide to Electromagnetic Distance Measurement.* Univ. of Toronto, 1967.

29.151 Survey Computations I

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 co-ordinates. Transformations. Spherical trigonometry and its application to survey problems. Resections and intersections: mathematical and semigraphic methods. Elementary programming for electronic computers.

TEXTBOOKS

Allan, A. L., Hollwey, J. R. & Maynes, J. H. B. *Practical Field Surveying and Computations.* Heinemann.

Seven Figure Mathematical Tables. Chambers, 1958.

Tables of Natural Sines, Tangents, etc. to every Ten Seconds. D.M.R., 1949,
or
Natural Trigonometrical Tables. Six Figures. Govt. Printer, Pretoria.

PRINCIPAL REFERENCE BOOK

Richardus, P. *Project Surveying.* North Holland, 1966.

29.152 Survey Computations II

Revision of basic error theory. Adjustment by least squares (a) parametric method; (b) method of correlatives. Solution of Normal Equations by elimination methods (a) Gauss-Doolittle; (b) Cholesky. Error ellipse calculations.

TEXTBOOKS

As for 29.151 Survey Computations I.

PRINCIPAL REFERENCE BOOKS

Rainsford, H. F. *Survey Adjustments and Least Squares.* Constable.

Richardus, P. *Project Surveying.* North Holland, 1966.

Shortrede, R. *Logarithms of Sines and Tangents for Every Second.* Layton.

Vega, G. *Seven Figure Logarithmic Tables.* Hafner Pub. Co., N.Y.

29.161 Hydrographic Surveying I

Principles, objectives, equipment and methods of hydrographic surveying.

29.162 Hydrographic Surveying II

Not offered in 1975.

29.182 Cartography Elective

Mathematical Cartography: map projections, Transverse Mercator, UTM and ISG. Topographic Cartography: representation of features, toponymy, map series. Thematic Cartography. History of Cartography.

TEXTBOOK

Robinson, A. H. *Elements of Cartography.* Wiley.

PRINCIPAL REFERENCE BOOKS

Greenhood, D. *Mapping.* Phoenix Science Series.

Monkhouse, F. J. & Wilkinson, H. R. *Maps and Diagrams.* Methuen.

Raisz, E. *General Cartography.* McGraw-Hill.

29.183 Cartography Advanced Elective

Not offered in 1975.

29.192 Survey Camp

A two-week field camp, including the preparation of a report and plans.

TEXT AND PRINCIPAL REFERENCE BOOKS

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 29.103 Surveying III, 29.152 Survey Computations II, 29.211 Geodesy I, 29.311 Astronomy I and 29.511 Photogrammetry I.

29.211 Geodesy I

Historical development of geodesy. The spheroid; curves on the spheroid. Legendres Theorem, computation of geographical co-ordinates. Geodetic survey-

ing (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, U.N.S.W.

PRINCIPAL REFERENCE BOOKS

Bomford, G. *Geodesy.* 3rd ed. O.U.P., 1971.

Clark, D. *Plane and Geodetic Surveying.* Vol. II. 5th ed. Constable, 1963.

Geodetic Triangulation. USC & GS. Special Publication.

Richardus, P. *Project Surveying.* North Holland, 1966.

The Australian Map Grid. Technical Manual. 2nd ed. National Mapping Council, Canberra, 1971.

29.212 Geodesy II

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.

PRINCIPAL REFERENCE BOOKS

Bomford, G. *Geodesy.* O.U.P., 1962.

Clark, D. *Plane and Geodetic Surveying.* Vol. II. 5th ed. Constable, 1963.

Jordan, W. & Eggert, O. *Handbook of Geodesy.* Carta, M. W. trans. Vols. I & III. U.S. Army Map Service, 1962.

Mather, R. S. *The Theory and Geodetic Use of some Common Projections.* School of Surveying, U.N.S.W.

Mueller, I. & Rockie, J. D. *Gravimetric and Celestial Geodesy – A Glossary of Terms.* Ungar, N.Y., 1966.

Rainsford, H. F. *Survey Adjustments and Least Squares.* Constable.

Reynolds, W. F. *Manual of Triangulation Computation and Adjustment.* U.S. Coast & Geodetic Survey Sp. Pub. 138, 1955.

Richardus, P. *Project Surveying.* North Holland, 1966.

Thomas, P. D. *Conformal Projections in Geodesy and Cartography.* U.S. Coast & Geodetic Survey Sp. Pub. 251, 1952.

29.213 Geodesy III

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 permanence of geodetic position. Long range goals of geodesy. Seminar.

PRINCIPAL REFERENCE BOOKS

As for 29.212 Geodesy II.

29.311 Astronomy I

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, 1964.

or

Textbook of Field Astronomy. H.M.S.O., 1960.

Star Almanac for Land Surveyors for Current Year. H.M.S.O.

29.312 Astronomy II

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. H.M.S.O.

PRINCIPAL REFERENCE BOOKS

Hoskinson, A. J. & Duerksen, J. A. *Manual of Geodetic Astronomy.* U.S. Coast & Geodetic Survey Sp. Pub. 237, 1952.

Roelofs, R. *Astronomy Applied to Land Surveying.* Ahrend, 1950.

29.313 Astronomy III

A study of topics selected from the following: Corrections to observations and calculations; star coordinates; meridian methods; equal altitude methods; precise timing.

PRINCIPAL TEXT AND REFERENCE BOOKS

As for 29.312 Astronomy II.

29.411 Surveying for Architects

Introduction. Chaining, methods of measurement, corrections, chain surveys. Level, differential levelling, booking. Contours, volumes of earthworks. Theodolite, methods of reading angles, applications in building. Traversing, setting out.

PRINCIPAL REFERENCE BOOKS

Foxall, H. G. *Handbook for Practising Land and Engineering Surveyors.* 2nd ed. Institution of Surveyors, N.S.W. Division, Sydney.

Whyte, W. S. *Basic Metric Surveying.* Butterworths, 1969.

Wright Perrott, S. *Surveying for Young Engineers.* A. L. Allan. rev. 3rd ed. Chapman & Hall, 1970.

29.431 Surveying and Cartography

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.

PRINCIPAL REFERENCE BOOKS

As for 29.411 Surveying for Architects.

29.441 Engineering Surveying

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, 1972. Paperback.

Seven Figure Mathematical Tables. Chambers, 1958.

PRINCIPAL REFERENCE BOOKS

Admiralty Manual of Hydrographic Surveying. Vol. I. Surveying on Shore. Hydrographic Department of the Navy, London, 1965.

Birchal, H. F. *Modern Surveying for Civil Engineers.* 2nd ed. Chapman & Hall. 1955.

Brinker, R. C. & Taylor, W. C. *Elementary Surveying.* 4th ed. International Textbook Co., 1964.

Clark, D. *Plane and Geodetic Surveying.* Vol. I. 6th ed. Constable, 1969.

Clark, D. *Plane and Geodetic Surveying.* Vol. II. 5th ed. Constable, 1963.

Hickerson, T. F. *Route Location and Design.* 5th ed. McGraw-Hill, 1967.

Sandover, J. A. *Plane Surveying.* Arnold, 1961.

Whyte, W. S. *Basic Metric Surveying.* Butterworths, 1969.

29.491 Survey Camp

A one-week field camp.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 29.441 Engineering Surveying.

29.511 Photogrammetry I

Stereoscopic vision. Geometry of single air photograph and stereoscopic pairs. Fundamental mathematical relationships. Radial triangulation. Inner, relative and absolute orientation with respect to direct optical projection. Cameras, physical properties of photographs.

TEXTBOOK

Moffit, F. H. *Photogrammetry.* 2nd ed. International Textbook Co., 1968.

PRINCIPAL REFERENCE BOOKS

Crone, D. R. *Elementary Photogrammetry.* Arnold, 1963.

Hallert, B. *Photogrammetry.* McGraw-Hill, 1960.

Manual of Photogrammetry. 3rd ed. Am. Soc. Photogram., 1966.

Zeller, M. *Textbook of Photogrammetry.* Lewis, 1952.

29.512 Photogrammetry II

Photogrammetric orientation. Design principles and practical application of exact and approximate restitution instruments. Flight and project planning. Aerial mapping. Aerial triangulation of strips.

TEXTBOOK

Moffit, F. H. *Photogrammetry.* 2nd ed. Int. Textbook Co., 1968.

PRINCIPAL REFERENCE BOOKS

Hallert, B. *Photogrammetry.* McGraw-Hill, 1960.

Manual of Photogrammetry. 3rd ed. Am. Soc. Photogram., 1966.

Zeller, M. *Textbook of Photogrammetry.* Lewis, 1952.

29.513 Photogrammetry III

Propagation of errors in aerial triangulation, and strip adjustment. Camera calibration. Rectification, Mosaics, Orthophotography.

TEXT AND PRINCIPAL REFERENCE BOOKS

As for 29.512 Photogrammetry II.

29.612 Land Studies II

A. 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.

B. 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.

C. 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, 1968.

Costin, A. B. & Frith, H. J. *Conservation.* Penguin, 1971.

Murray, J. F. N. *Principles and Practice of Valuation.* C'wealth Inst. of Valuers, 1966.

or

Rost, R. O. & Collins, H. G. *Land Valuation and Compensation in Australia.* C'wealth Inst. of Valuers, 1971.

29.613 Land Studies III

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 N.S.W.* Institution of Surveyors, Sydney, 1973.

Willis, R. W. *Survey Investigation.* Registrar-General's Dept.

PRINCIPAL REFERENCE BOOK

Dowson, E. M. & Sheppard, V. L. O. *Land Registration.* H.M.S.O., 1956.

29.614 Land Studies Project

A project involving the preliminary survey, analysis and all aspects of design for a development.

29.615 Land Studies

Advanced studies in residential and industrial subdivisional design and presentation. Conflict of demand for land use; environmental control. Integrated survey applications. Data banks.

NON-ENGINEERING SUBJECTS

(For General Studies subjects see the Department of General Studies Handbook.)

1.001 Physics I

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

Bueche, F. *Introduction to Physics for Scientists and Engineers.* McGraw-Hill.

REFERENCE BOOKS

Ference, M., Lemon, H. & Stephenson, R. J. *Analytical Experimental Physics.* Chicago U.P.

Halliday, D. & Resnick, R. *Physics for Students of Science and Engineering.* Vols. I & II. Wiley.

Wiedner, R. T. V. & Sells, R. L. *Elementary Classical Physics.* Vols. I & II. Allyn & Bacon.

1.011 Higher Physics I

Kinematics – non-uniformly accelerated systems. Centripetal acceleration. Laws of motion. Momentum. Impulse. Potential and kinetic energy. Power. Conditions of equilibrium. Elasticity. Young's bulk and shear moduli. Poisson's ratio. Strain energy. Hydrodynamics. Bernouilli's equation. Motion in resistive medium. Moments of inertia. Rotational dynamics. Simple harmonic motion. Pendulums. Motion about free axis. Progressive and stationary waves. Energy current. Superposition of waves. Doppler effect. Resonance. Huygen's principle. Reflection, refraction, interference and diffraction of waves. Electromagnetic spectrum. Polarization.

Electrostatics – Gauss' theorem. Electric intensity. Capacitance. Electromagnetism. Biot-Savart and Ampere's circuital laws. Force on moving charge and on conductor. Torque on coil. D.C. instruments. Electromagnetic induction. Faraday's and Lenz's laws. Self and mutual inductance. D.C. circuits. Kirchhoff's rules and Thevenin's theorem. Growth and decay of current. A.C. circuits. Resonance. Diode. Triode. Amplifiers and oscillators. Electronic measuring instruments.

TEXTBOOKS

Halliday, D. & Resnick, R. *Physics for Students of Science and Engineering.* Vols. I and II, or combined volume. Wiley, 1960.

Russell, G. J. & Mann, K. *Alternating Current Circuit Theory.* N.S.W. Univ. Press.

Spiegel, M. R. *Theory and Problems of Theoretical Mechanics.* Schaum.

PRINCIPAL REFERENCE BOOKS

Brophy, J. J. *Basic Electronics for Scientists.* McGraw-Hill. Paperback.

Feynman, R. P., Leighton, R. B. & Sands, M. *The Feynman Lectures on Physics.* Vols. I and II. Addison-Wesley.

Tomboulian, D. H. *Electric and Magnetic Fields.* Harcourt, Brace & World, N.Y., 1965.

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

Electrostatics in vacuum and in dielectrics. Magnetostatics in vacuum and in magnetic materials. Maxwell's equations and simple applications.

TEXTBOOK

Reitz, J. R. & Milford, F. J. *Foundation of Electromagnetic Theory.* 2nd ed. Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

Schwarz, W. M. *Intermediate Electromagnetic Theory.* Wiley, 1964.

Whitmer, R. M. *Electromagnetics.* 2nd ed. Prentice-Hall, 1963.

1.112B Modern Physics

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

Beiser, A. *Perspectives of Modern Physics.* Rev. ed. McGraw-Hill, 1969.

PRINCIPAL REFERENCE BOOKS

Arya, A. P. *Elementary Modern Physics.* Addison-Wesley.

Eisberg, R. M. *Fundamentals of Modern Physics.* Wiley.

Mermin, N. D. *Space and Time in Special Relativity.* McGraw-Hill, 1968.

1.112C Thermodynamics and Mechanics

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, elasticity, 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 of continuous systems, waves, wave packet group velocity.

TEXTBOOKS

French, A. P. *Vibrations and Waves.* Nelson, 1971.

Mandl, F. *Statistical Physics.* Wiley, 1971.

Stephenson, R. J. *Mechanics and Properties of Matter.* Wiley, 1969.

PRINCIPAL REFERENCE BOOKS

Pain, H. G. *Physics of Vibrations and Waves.* Wiley, 1968.

Spiegel, M. R. *Theoretical Mechanics.* Shaum.

Symon, K. R. *Mechanics.* Addison-Wesley, 1960.

1.122A Electromagnetism

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

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, 1961.

PRINCIPAL REFERENCE BOOKS

Mermin, N. D. *Space and Time in Special Relativity.* McGraw-Hill, 1968.

Resnick, R. *Introduction to Special Relativity.* Wiley, 1968.

1.122C 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, 1965.

PRINCIPAL REFERENCE BOOKS

Crawford, F. S. *Waves,* Berkley Physics. Vol. III. McGraw-Hill.

Goldstein, H. *Classical Mechanics.* Addison-Wesley.

Reif, F. *Fundamentals of Statistical and Thermal Physics.* McGraw-Hill.

Spiegel, M. R. *Theoretical Physics.* Schaum.

2.001 Chemistry I

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 proeprties of organic and inorganic compounds. Reactions of organic and inorganic compounds.

TEXTBOOKS

Aylward, G. H., & Findlay, T. J. V. *SI Chemical Data.* Wiley, Sydney, 1974.

Chemistry I – Laboratory Manual. Univ. of N.S.W., 1975.

Kneen, W. R., Rogers, M. J. W. & Simpson, P. *Chemistry: Facts, Patterns and Principles.* Addison-Wesley, 1972.

Schaum Outline Series. *Theory and Problems of College Chemistry.* SI (metric) ed. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L. & Thompson, W. E. *Understanding Chemistry.* Benjamin, 1969.

Brown, G. I. *A New Guide to Modern Valency Theory.* Longman, 1967.

Eastwood, F. W., Swan, J. M. & Yonatt, J. B. *Organic Chemistry. A First University Course in Twelve Programs.* Science Press, 1967.

Gray, H. B. & Haight, G. P. *Basic Principles of Chemistry.* Benjamin, 1967.

Pauling, L. *College Chemistry.* 3rd ed. Freeman, N.Y., 1964.

Runquist, O., Cresswell, C. J. & Head, J. T. *Chemical Principles. A Programmed Text.* Burgess Pub. Co., 1968.

Sisler, H. H., Van der Werf, C. A. & Davidson, A. W. *College Chemistry.* 3rd ed. Collier-Macmillan, 1967.

Vogel, A. I. *Macro and Semimicro Qualitative Analysis.* 4th ed. Longman, 1954.

2.021 Chemistry IE

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, 1974.

Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L. & Thompson, W. E. *Understanding Chemistry.* Benjamin, 1969.

Chemistry IE. Laboratory Manual. Univ. of N.S.W., 1975.

Turk, A., Meislich, H., Brescia, F. & Arents, J. *Introduction to Chemistry.* Academic, 1968.

PRINCIPAL REFERENCE BOOK

Munro, L. A. *Chemistry in Engineering.* Prentice-Hall, 1964.

4.913 Materials Science

The structure and properties of crystalline substances. Crystal structures, crystal planes and directions. Examination of crystals by X-ray, electron and neutron diffraction techniques. The properties of crystalline solids. Defect structure of crystals. Influence of defects on the behaviour of crystals. The

properties of metals and metallic alloys in terms of modern theories. The development of alloys for specific engineering applications. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials.

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

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

4.921 Materials Science

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

Van Vlack, L. H. *A Textbook of Materials Technology.* Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

Azaroff, L. V. & Brophy, J. J. *Electronic Processes in Materials.* McGraw-Hill.

Barrett, C. R. *The Principles of Engineering Materials.* Prentice-Hall.

Pfann, W. G. *Zone Melting.* Wiley.

4.931 Metallurgy

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

Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley.

Van Vlack, L. H. *A Textbook of Materials Technology.* Addison-Wesley.

4.941 Metallurgy for Engineers

The structure and properties of solids, with special reference to metals and metallic alloys which are of use to the engineer.

TEXTBOOKS

Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley.

or

Barrett, C. R. *The Principles of Engineering Materials.* Prentice-Hall.

10.001 Mathematics I

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

TEXTBOOKS

Blatt, J. M. *Basic Fortran IV Programming.* Minitran Version. Computer Systems (Aust.).

Shields, P. C. *Elementary Linear Algebra.* 2nd ed. Worth.

Thomas, G. B. *Claculus and Analytic Geometry.* 4th ed. Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

Campbell, H. F. *Matrices with Applications.* Appleton-Century-Crofts.

Cohn, P. M. *Solid Geometry.* Routledge.

Kaplan, W. & Lewis, D. J. *Calculus and Linear Algebra.* Vols. 1 & 2. Wiley.

Kelly, G. M. *Introduction to Linear Algebra and Vector Geometry.* Reed Education, Sydney, 1971.

Lange, I. H. *Elementary Linear Algebra.* Wiley.

Pedoe, D. A. *A Geometric Introduction to Linear Algebra.* Wiley.

Purcell, E. J. *Calculus with Analytic Geometry.* Appleton-Century-Crofts.

Smith, W. K. *Limits and Continuity.* Collier-Macmillan.

Tetra, B. C. *Basic Linear Algebra.* Harper & Row.

Zelinsky, D. *A First Course in Linear Algebra.* Academic.

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?* O.U.P.

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

Calculus, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

TEXTBOOKS

Blatt, J. M. *Basic Fortran IV Programming.* Minitran Version. Computer Systems (Aust.).

Shields, P. C. *Elementary Linear Algebra.* 2nd ed. Worth.

Spivak, M. *Calculus.* Benjamin.

PRINCIPAL REFERENCE BOOKS

As for 10.001 Mathematics I plus:

Abraham, R. *Linear and Multilinear Algebra.* Benjamin.

Bellman, R. & Cooke, K. L. *Modern Elementary Differential Equations.* 2nd ed. Addison-Wesley.

Brauer, F. & Nohel, J. *Ordinary Differential Equations.* Benjamin.

Burkhill, J. C. *A First Course in Mathematical Analysis.* C.U.P.

Crowell, R. H., & Williamson, R. E. *Calculus of Vector Functions.* Prentice-Hall.

Hochstadt, H. *Differential Equations.* Holt, Rinehart & Winston.

Lang, S. *Linear Algebra.* Addison-Wesley.

Murdoch, D. C. *Linear Algebra for Undergraduates.* Wiley.

Spivak, M. *Calculus on Manifolds.* 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.

10.021 Mathematics IT

Calculus, analysis, analytic geometry, algebra, probability theory, elementary computing.

TEXTBOOKS

Blatt, J. M. *Basic Fortran IV Programming.* Minitran Version. Computer Systems (Aust.).

Greening, M. G. *First Year General Mathematics.* N.S.W.U.P.

Youse, B. K. & Stalnaker, A. W. *Calculus for the Social and Natural Sciences.* International Textbook Co.

PRINCIPAL REFERENCE BOOKS

Burford, R. L. *Introduction to Finite Probability.* Merrill.

Christian, R. C. *Logic and Sets.* Blaisdell.

Hoyt, J. P. *A Brief Introduction to Probability Theory.* International Text Book Co.

Johnson, W. G. & Zaccaro, L. N. *Modern Introductory Mathematics.* McGraw-Hill.

10.022 Engineering Mathematics II

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.

TEXTBOOKS

Giles, E., Pretorius, W. J. & Prokhovnik, S. J. *Supplement to Mathematical Methods.* Science Press.

Keane, A. & Senior, S. A. eds. *Mathematical Methods.* 2nd ed. Science Press.

PRINCIPAL REFERENCE BOOKS

Hildebrand, F. B. *Advanced Calculus for Applications.* Prentice-Hall.

Kreyszig, E. *Advanced Engineering Mathematics.* Wiley.

Pipes, L. A., & Harvill, L. R. *Applied Mathematics for Engineers and Physicists.* 3rd ed. McGraw-Hill.

Spiegel, M. R. *Advanced Mathematics for Engineers and Scientists.* McGraw-Hill.

10.033 Electrical Engineering Mathematics III

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.

PRINCIPAL REFERENCE BOOKS

Carslaw, H. S. & Jaeger, J. C. *Operational Methods in Applied Mathematics.* Dover.

Churchill, R. V. *Fourier Series and Boundary Value Problems.*. 2nd ed.. McGraw-Hill.

Danese, A. E. *Advanced Calculus.* Vol. I. Allyn & Bacon.

Hague, B. *An Introduction to Vector Analysis.* Methuen.

Pipes, L. A. *Applied Mathematics for Engineers and Physicists.* 2nd ed. McGraw-Hill.

Slater, J. C. & Frank, N. H. *Electromagnetism.* McGraw-Hill.

Tralli, N. *Classical Electromagnetic Theory.* McGraw-Hill.

Tranter, C. J. *Integral Transforms.* Methuen.

10.111A Pure Mathematics II – Linear Algebra

Vector Spaces: inner products, linear operators, spectral theory, quadratic forms. Linear Programming: convex sets and polyhedra, feasible solutions, optimality, duality.

TEXTBOOKS

SESSION 1

Tropper, A. M. *Linear Algebra.* Nelson. Paperback.

SESSION 2

Gass, H. *Linear Programming.* ISE. McGraw-Hill.

Tropper, A. M. *Linear Algebra.* Nelson. Paperback.

PRINCIPAL REFERENCE BOOKS

Lang, S. *Linear Algebra.* Addison-Wesley.

Hoffman, K. & Kunze, R. *Linear Algebra.* Prentice-Hall.

Lipschutz, S. *Linear Algebra.* Schaum.

10.111B Pure Mathematics II – Analysis

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.

PRINCIPAL REFERENCE BOOKS

Hilton, P. J. *Partial Derivatives.* Routledge.

Thomas, G. B. *Calculus and Analytic Geometry.* 4th ed. Addison-Wesley.

10.211A Applied Mathematics II – Mathematical Methods

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.* Minitran 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.

PRINCIPAL REFERENCE BOOKS

Betz, H., Burcham, P. B. & Ewing, G. M. *Differential Equations with Applications.* I.S.R. Harper.

Dettman, J. W. *Mathematical Methods in Physics and Engineering.* McGraw-Hill.

Smith, G. D. *Vector Analysis Including the Dynamics of a Rigid Body.* O.U.P.

10.341 Statistics SU

An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of x^2, t and F. Estimation by moments and maximum likelihood; confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression. Least squares adjustment of data.

TEXTBOOK

Statistical Tables.

PRINCIPAL REFERENCE BOOK

Brownlee, K. A. *Statistical Theory and Methodology in Science and Engineering.* 2nd ed. Wiley.

10.351 Statistics SM

For students in Aeronautical, Industrial and Mechanical Engineering and Naval Architecture as part of 5.071 Engineering Analysis.

An introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial, Poisson and normal distributions. Sampling distributions, with emphasis on those derived from the normal distribution: t, x^2 and F. Estimation of parameters: the methods of moments and maximum likelihood, and confidence interval estimation. The standard tests of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

TEXTBOOKS

Freund, J. E. *Mathematical Statistics.* 2nd ed. Prentice-Hall.

Statistical Tables.

PRINCIPAL REFERENCE BOOKS

Derman, C. & Klein, M. *Probability and Statistics Inference for Engineers.* O.U.P.

Freeman, H. *Introduction to Statistical Inference.* Addison-Wesley.

Hald, A. *Statistical Theory with Engineering Applications.* Wiley.

10.361 Statistics SE

For students in Electrical Engineering.

As for 10.351 Statistics SM, with the addition of auto-correlation.

TEXTBOOKS

As for 10.351 Statistics SM.

14.001 Introduction to Accounting

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. Relevance of accounting to managerial and technological functions including planning, decision-making and control.

PRELIMINARY READING

Anthony, R. N. *Essentials of Accounting.* Addison-Wesley, 1964.

TEXTBOOK

Fertig, P. E., Istvan, D. F., & Mottice, H. J. *Using Accounting Information.* 2nd ed. Harcourt, Brace & World, 1971.

27.293 Physical Geography for Land Assessment

Physical characteristics of land and their determinants, including climate, geology, landforms, soils, and vegetation. Emphasis on land types in the Sydney area. Principles and techniques of land classification with special reference to work in Australia. Classification for land potential. Laboratory classes support the study of physical factors determining land character, and also illustrate the use of airphotos in the identification and mapping of land types. There is a one-day tutorial in the Sydney region.

TEXTBOOK

Mitchell, C. *Terrain Evaluation.* Longman.

PRINCIPAL REFERENCE BOOKS

Bach, W. *Atmospheric Pollution.* McGraw-Hill.

Barry, R. G. & Chorley, R. J. *Atmosphere, Weather and Climate.* Methuen.

Bartelli, L. J. et al. *Soil Surveys and Land Use Planning.* Soil Science Society & American Society of Agronomy.

Billings, W. D. *Plants and the Ecosystem.* Macmillan.

Bird, E. C. F. *Coasts.* A.N.U. Press.

Branagan, D. F. & Packham, C. H. *Field Geology of New South Wales.* Science Press.

Bridges, E. M. *World Soils.* C.U.P.

Buckman, N. C. & Brady, H. O. *The Nature and Properties of Soil.* Macmillan.

Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.

Corbett, J. R. *The Living Soil.* Martindale.

CSIRO. *The Australian Environment.* M.U.P.

Davies, J. L. *Geographical Variation in Coastal Development.* Oliver & Boyd.

Dickinson, G. C. *Statistical Mapping and the Presentation of Statistics.* Arnold.

Geiger, R. *The Climate near the Ground.* Harvard U.P.

Gentilli, J. *Australian Climatic Patterns.* Nelson.

Griffiths, J. F. *Applied Climatology.* O.U.P.

Gunn, R. H. et al. *Lands of the Queanbeyan-Shoalhaven Area, A.C.T. and N.S.W.* CSIRO Land Research Series No. 24.

McHarg, I. *Design with Nature.* American Museum of Natural History, N.Y.

Moore, R. M. ed. *Australian Grasslands.* A.N.U. Press.

Morisawa, M. *Streams.* McGraw-Hill.

Seddon, G. *Sense of Place.* W. Aust. U.P.

Selby, M. J. *Slopes and Slope Processes.* N.Z.Geog.Soc.

Stewart, G. A. ed. *Land Evaluation.* Macmillan.

Storey, R. et al. *General Report on the Lands of the Hunter Valley.* CSIRO Land Research Series No. 8.

Van Riper, J. E. *Man's Physical World.* McGraw-Hill.

31.212 Geometrical Optics

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. Trigonometrical ray tracing. Photometry.

TEXTBOOK

Fincham, W. H. A. & Freeman, M. H. *Optics.* 8th ed. Butterworths, 1974.

36.411 Town Planning

The study of factors influencing the direction of the development and use of land in the public interest. Objectives of town and regional planning; urban land process; patterns and processes of urbanization; the industrial and urban revolution; housing and neighbourhood planning; civic design, planning law and administration; the Sydney Region Outline Plan; industrial location and decentralisation; "Tomorrow's Canberra"; the future city.

PRINCIPAL REFERENCE BOOKS

Abercrombie, P. *Town and Country Planning.* 3rd ed. O.U.P., 1959.

Brown, A. J. & Sherrard, H. M. *Town and Country Planning.* 2nd ed. A. & R., 1969.

Colman, J. *Planning and People.* A. & R.

Mumford, L. *The City in History.* Secker & Warburg.

Stretton, H. *Ideas for Australian Cities.* Griffin Press.

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										

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The Deputy Registrar (Student Services), Mr. P. O'Brien, is located on the first floor of the Chancellery. See Mr. O'Brien or Mr. S. Briand for matters relating to *financial problems* (he may be able to arrange a loan). 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* contact Mr J. Grigg (Phone 2143). This section can also advise on matters relating to *discontinuation of subjects* and *termination of courses.*

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 2485.

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.

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. Library enquiries should be directed to 2649.

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 3 of the Union where the SU full-time President or Education Vice-President are available to discuss any educational problems you might have. In addition to dispensing free educational advice the SU offers a diverse range of 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, Speer, Concessions Book and countercourse handbooks. For information about these phone 2929.

This Handbook has been specially designed as a source of reference for you and will prove useful for consultation throughout the year at this University.

For fuller details about the University—its organization, staff membership, description of courses and so on, you should consult the University 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 General Studies.

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 between one dollar and $1.50 (plus 20 cents postage), with the exception of General Studies, which is available free of charge.